TM 11-4043

WAR DEPARTMENT TECHNICAL MANUAL

SPEECH AMPLIFIERS

BC-614-A,-B,-C,-D,-E, and -F

REPAIR INSTRUCTIONS

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WAR DEPARTMENT • OCTOBER 1945

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TM 11–4043, Speech Amplifiers BC–614–A, –B, –C, –D, –E, and –F, Repair Instructions, is published for the information and guidance of all concerned.

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Chief of Staff

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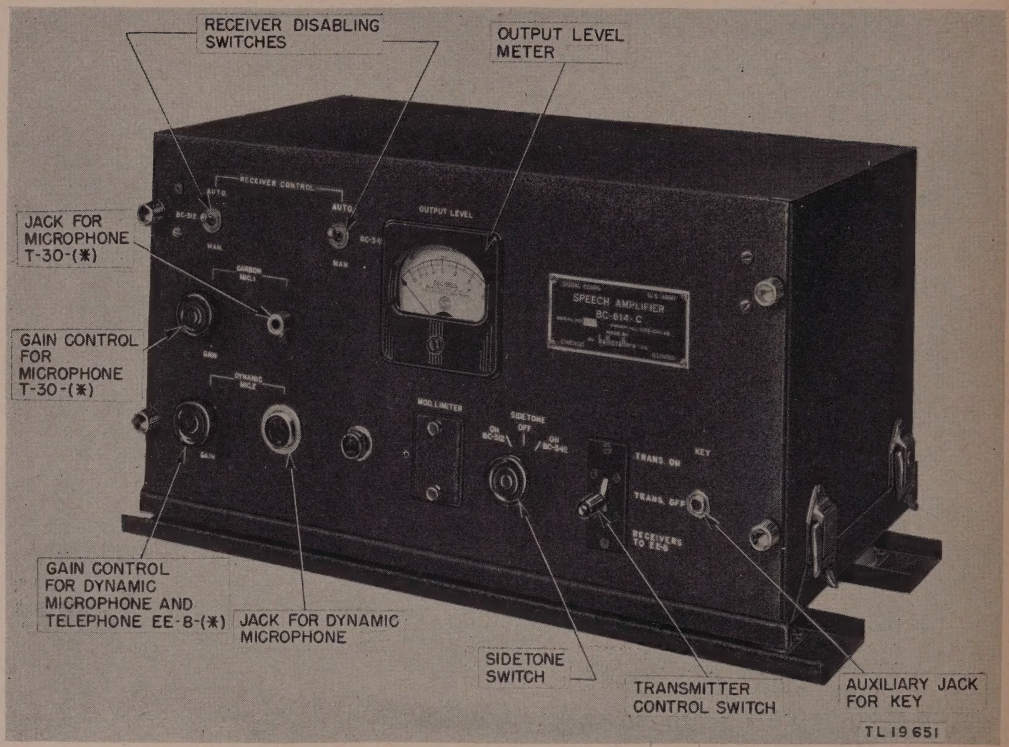


Figure 1. Speech Amplifier BC–614–C, front view.

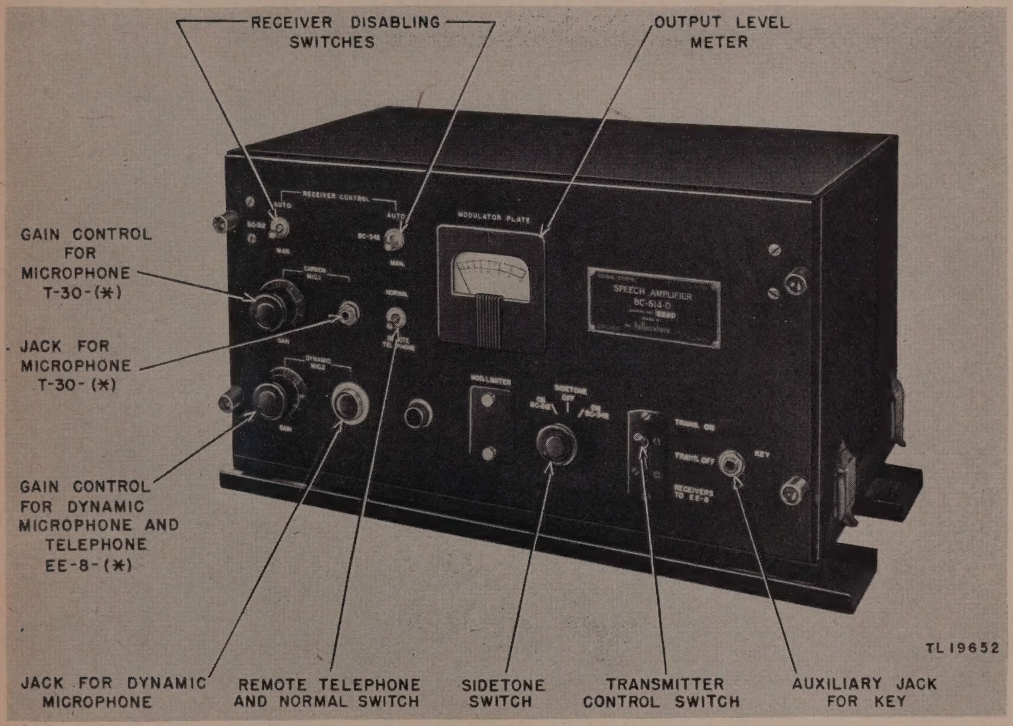


Figure 2. Speech Amplifier BC–614–D, front view.

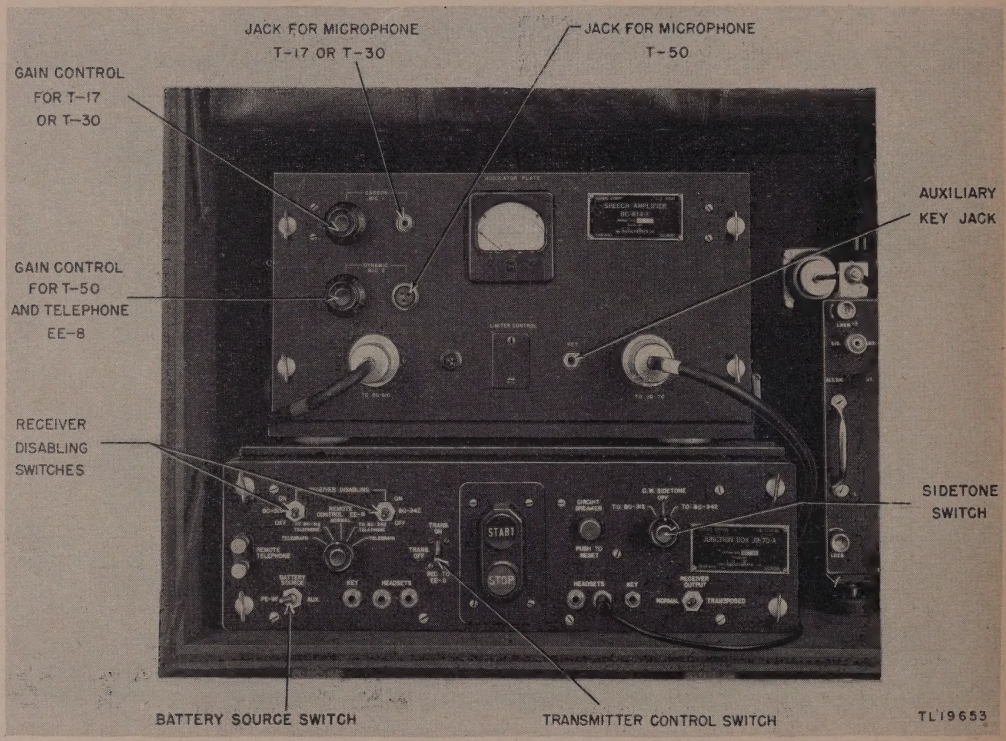


Figure 3. Speech Amplifier BC-614-E, front view

SECTION I

DESCRIPTION OF SPEECH AMPLIFIERS BC–614–A, –B, –C, –D, –E, AND –F*

1. General

a. Speech Amplifier BC–614–(*) is a part of Radio Transmitter BC–610–(*), which in turn is part of Radio Sets SCR–299–(*), SCR–399–(*), and SCR–499–(*). These are highpower radio stations capable of providing amplitude-modulated voice or continuous-wave (c-w) communication over a range of approximately 100 miles, depending upon conditions of atmosphere and terrain. Communication over this range is possible either from a stationary position or while moving at high speeds over rough roads.

b. Official nomenclature followed by (*) is used to indicate all models of the item of equipment included in this Technical Manual. Thus Speech Amplifier BC–614–(*) represents Speech Amplifiers BC–614–A, –B, –C, –D, –E, and –F, which are treated together in this manual.

c. The chief function of the speech amplifier is to amplify the output of the microphone to a level suitable for input to the transmitter audio circuit when voice modulation is desired. The front panel controls of the speech amplifier also provide for:

(1) Control of SIDETONE OFF-ON switch for receiver monitoring of c-w transmissions (except in BC–614–E).

(2) Control of manual or automatic receiver disabling (AUDIO.-MAN. switch) for protection of the receiver when receiving on or near the transmitter frequency or its harmonics (except in BC–614–E).

(3) Control of the transmitter final-amplifier plate voltage (TRANS. ON switch).

(4) Control of the receiver output to Telephone EE–8–(*) line (RECEIVER TO EE–8 switch).

(5) Control of NORMAL-REMOTE TELEPHONE switch (found on Speech Amplifier BC–614–D and BC–614–F only).

(6) Audio gain adjustments for Microphones T–30–(*) (CARBON MIC. 1) and T–50–(*) (DYNAMIC MIC. 2). Speech Amplifier BC–614–(*) contains its own plate supply unit which operates on 115-volt, 50- to 60-cycle alternating current, drawing approximately 40 watts.

d. The following cords are used in conjunction with the speech amplifier:

(1) The transmitter control cord, which is 10 feet long, conducts speech and control circuits to Radio Transmitter BC–610–(*) and furnishes Speech Amplifier BC–614–(*) with alternating-current (a-c) power. One end plugs into the rear of the transmitter, and the other end plugs into the back of the speech amplifier chassis.

(2) The operating control cord is 30 inches long and connects circuits from controls on Table MC–269–(*) to Speech Amplifier BC–614–(*). Plug receptacles are supplied for this cord in the wiring channel and in the rear of the speech amplifier.

e. Speech Amplifier BC–614–(*) is encased in a rectangular sheet steel cabinet which is anchored to a base equipped with rubber shock absorbers. (See figs. 1, 2, and 3.) The cabinet can be easily removed from the base by loosening four hasps on the side of the cabinet. All of the electrical parts are attached either to a panel or a chassis, which together form an integral assembly that slides out from the front of the cabinet when four thumb screws located in the corners of the panel are loosened. (See figs. 4 and 5.) The chassis contains all of the tubes and their associated circuits. The panel contains the operating controls (in BC–614–E, Junction Box JB–70–A (fig. 3) holds many of the controls) and the OUTPUT LEVEL meter across the audio transmission line to the transmitter's audio circuits. In Speech Amplifier BC–614–E and Speech Amplifier BC–614–F the OUTPUT LEVEL meter is replaced by a MODULATOR PLATE meter.

2. Over-All System Function

a. A simplified block diagram of Speech Amplifier BC–614–(*) is shown in figure 6. It contains blocks representing the following circuits: microphone input amplifier; voltage amplifier with automatically controlled grid bias; voltage amplifier and phase inverter; push-pull output amplifier; amplifier and rectifier for the voice limiter circuits; and the sidetone oscillator circuit.

b. The audio-frequency voltage from the dynamic microphone enters the amplifier at terminal No. 3 of socket S0101. After passing through a

*See TM 11-281 for installation, operation, and other maintenance data on this equipment.

network of resistors, the voltage is impressed on the grid of tube V101. The output voltage of the tube is then fed through the low-level gain control to the grid of tube V102. This tube is the second voltage amplifier. Should the carbon microphone be in use, the input voltage enters the speech amplifier through jack J102 and after passing through a transformer and carbon-microphone gain control, is fed to the grid of tube V102. When it is desired to use either the remote or local telephone, the speech current enters the speech amplifier through terminal No. 5 of socket S0103 (terminal No. 3 of socket S0102 in BC–614–E) and then passes through a switch and resistor to the grid of tube V101. The amplified speech voltage, after passing through tubes V101 and V102 are fed to the grid of one section of tube V103. One triode section of tube V103 operates as a conventional voltage amplifier. The output voltage is fed both to the grid of one section of tube V104 and to the second grid of tube V103. Here it is amplified and is fed in proper phase to the second grid of tube V104 so that true push-pull action is obtained. The output of tube V104 is delivered to the primary of the output transformer. The secondary of the output transformer is connected through a low impedance line to socket S0104 (S0103 in BC–614–E), which is the output to the transmitter. (See figs. 7 and 8.) The relative strength of the output signal fed to the transmitter is registered on the OUTPUT LEVEL meter (the MODULATOR PLATE meter in BC–614–E and BC–614–F).

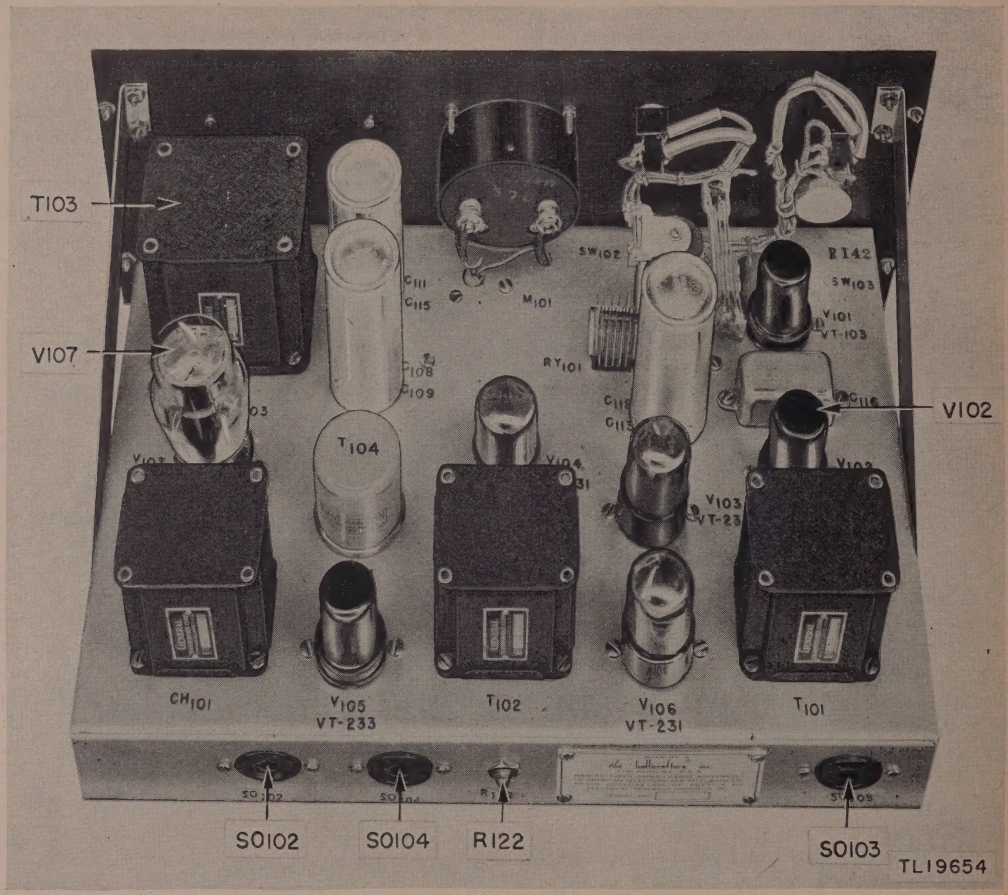


Figure 4. Speech Amplifier BC–614–A, –B, and –C, interior view.

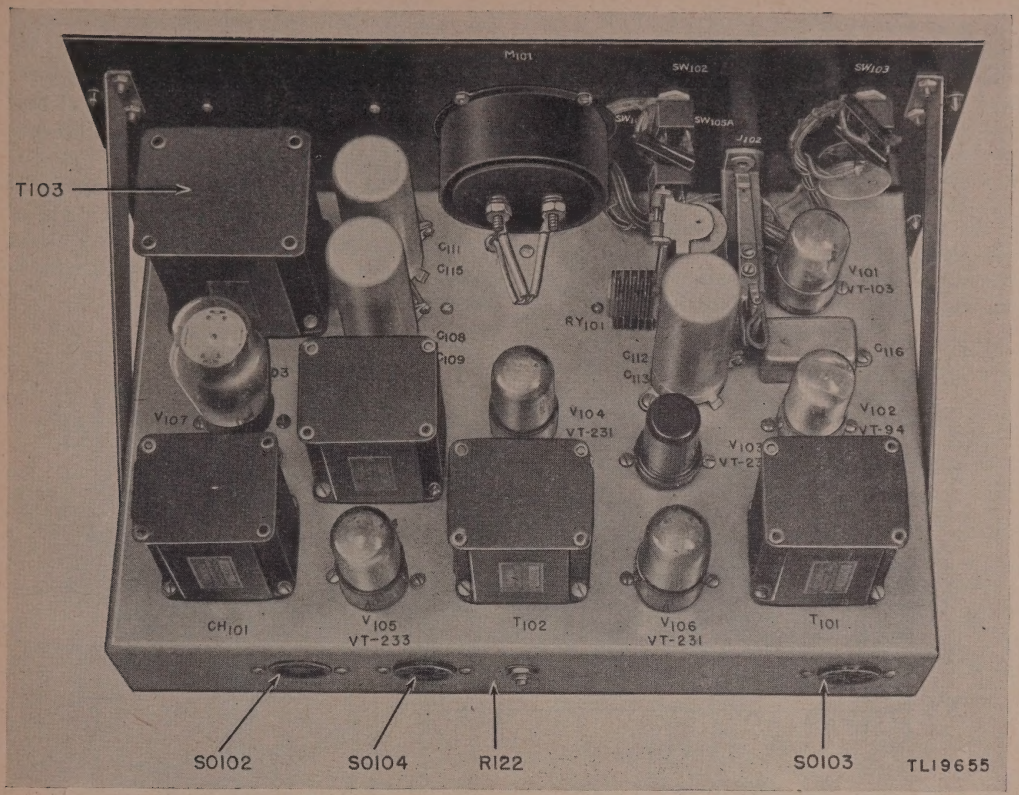


Figure 5. Speech Amplifier BC–614–D, interior view.

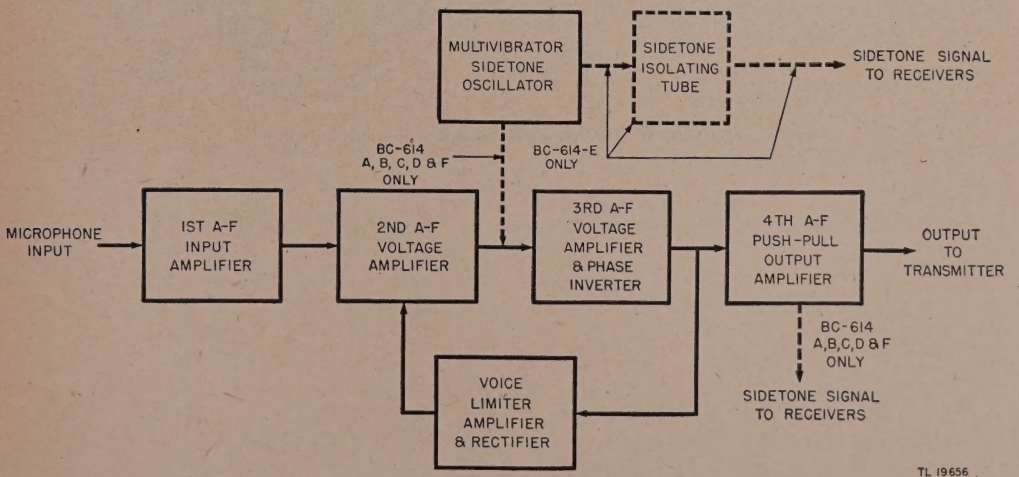

MULTIVIBRATOR SIDETONE OSCILLATOR
SIDETONE ISOLATING TUBE
SIDETONE SIGNAL TO RECEIVERS
BC-614 A, B, C, D & F ONLY
BC-614-E ONLY
MICROPHONE INPUT
1ST A-F INPUT AMPLIFIER
2ND A-F VOLTAGE AMPLIFIER
3RD A-F VOLTAGE AMPLIFIER & PHASE INVERTER
4TH A-F PUSH-PULL OUTPUT AMPLIFIER
OUTPUT TO TRANSMITTER
BC-614 A,B,C,D & F ONLY
SIDETONE SIGNAL TO RECEIVERS
VOICE LIMITER AMPLIFIER & RECTIFIER
TL 19656

Figure 6. Speech Amplifier BC–614–A, –B, –C, –D, –E, and –F, simplified block diagram.

c. A portion of the voltage of tube V104 is fed through the volume limiter control to the grid of tube V105. After amplification, rectification, and filtering, the output is then applied as a variable bias voltage to the grid of tube V102, which has the property of varying its amplification constant with grid bias variations.

d. For monitoring purposes the audio oscillator of the speech amplifier is keyed in parallel with the oscillator of Radio Transmitter BC–610–(*). When the key is pressed, the output of tube V106 (an audio oscillator of the multivibrator type) is fed to the headphones of either radio receiver used with the test. Sufficient output is provided by delivering a portion of the audio oscillator output to the grid of tube V103. It is amplified first through tube V103, then through tube V104 and conducted to the appropriate receiver.

e. In BC–614–E, a portion of the audio signal voltage developed by V106 is fed to the grid of V108. Tube V108 isolates V106 from external keying circuits to prevent frequency changes in the output signal voltage.

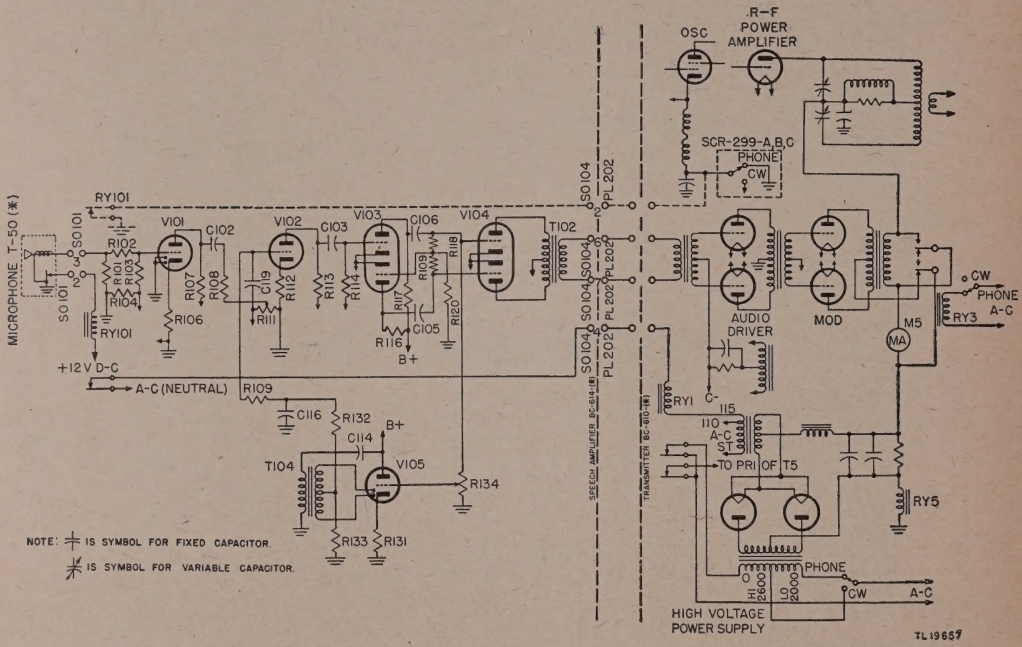


Figure 7. Radio Set SCR–299, functional diagram of voice operation.

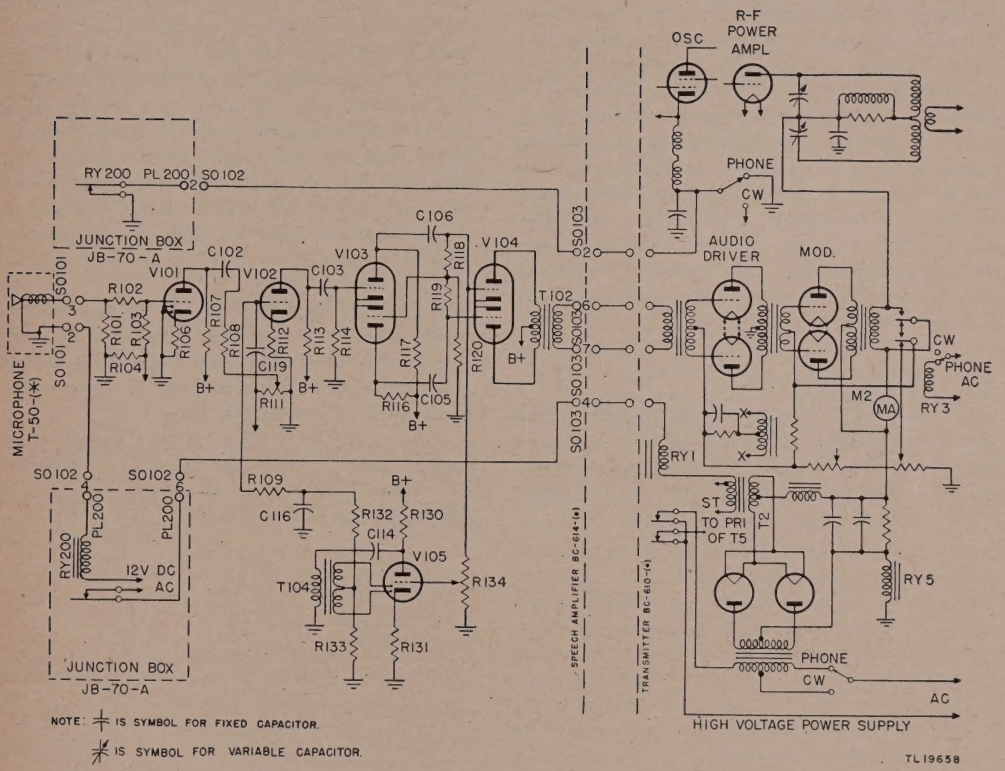


Figure 8. Radio Sets SCR–399–A and SCR–499–A, functional diagram of voice operation.

SECTION II

DIFFERENCES BETWEEN MODELS

3. Mechanical Differences

a. Speech Amplifiers BC–614–A, BC–614–B, and BC–614–C are securely mounted on the shelf under the top of Table MC–269, whereas Speech Amplifier BC–614–D is fastened to the top of Table MC–269–A, and Speech Amplifier BC–614–E is located in Chest CH–120–A where it is securely mounted on top of Junction Box JB–70–A.

b. The receiver disabling switches, transmitter control switch, and sidetone switch are installed on the panel of Speech Amplifiers BC–614–A, BC–614–B, BC–614–C, BC–614–D, and BC–614–F. The receiver disabling switches, transmitter control switch, and sidetone switch for Speech Amplifier BC–614–E are located on Junction Box JB–70–A.

4. Electrical Differences

a. Terminals. In Speech Amplifier BC–614–E the voltages from the speech circuits enter the speech amplifier through terminal No. 3 of socket SO102 instead of through terminal No. 5 of socket SO103 as in the other models.

b. Switches. There are no disabling switches located in Speech Amplifier BC–614–E.

c. Tubes. Speech Amplifier BC–614–E contains an additional tube (tube V108). A portion of the audio signal voltage developed by tube V106 is applied to the grid of tube V108 (JAN–6J5). The purpose of tube V108 is to isolate the multivibrator stage from external keying circuits which would otherwise cause frequency changes in the multivibrator output signal voltage. Grid bias for V108 is obtained by the drop across cathode resistor R122. Audio signal voltage for keying is taken from the cathode of tube V108 through resistor R141 and impressed on terminal No. 5 of socket SO102.

d. C-w Operation. Keying of the sidetone oscillator in BC–614–E is accomplished by inserting the plug on cord of Key J–37 into one of the jacks provided in Junction Box JB–70–A instead of the jack located on the panel.

e. Remote Operation. When remote operation of Speech Amplifier BC–614–E is desired, Telephone EE–8–(*) is connected through terminal No. 3 of socket SO102.

SECTION III
INITIAL REPAIR PROCEDURES

Note. Before any repairs or adjustments are made, all authorized modification work orders should be applied. See FM 21–6 for list of applicable MWO's.

5. General

Maintenance personnel should follow the procedure outlined in this manual when repairing and overhauling Speech Amplifier BC–614–(*). The repair information in this and the following sections is presented in the order in which the repairman should actually perform the various operations on the equipment in the repair shop. This procedure permits repair of the equipment in the shortest time possible, resulting in performance comparable to that of new equipment.

6. Tools, Test and Cleaning Equipment

The following items should be available when overhauling and repairing this equipment.

Item	Description
Audio oscillator	Range of 100 to 2,000 cps
Voltmeter	Range of 1 to 1,000 volts, a-c and d-c; 1,000 ohms per volt
Vacuum-tube voltmeter	A-c range of 1 to 25 volts
Ohmmeter	Range of 1 ohm to 2 megohms
Radio Transmitter BC–610–(*).	
Load resistors	500-ohm, 10-watt, wire-wound 250,000-ohm, ½-watt, carbon 500,000-ohm, ½-watt, carbon 100-ohm, 10-watt, wire-wound 200-ohm, 10-watt, wire-wound
Tube tester	Dynamic type
Loudspeaker	Loudspeaker LS–3 or equivalent
Microphone	Microphone T–50 or equivalent, dynamic type
Microphone	Microphone T–30 or equivalent, carbon type
Oscilloscope	20 to 20,000 cps
Sandpaper	#0000
Assorted brushes	
Crocus cloth	
Insulated probe	
Dental mirror	
Rubber or felt pad	
Padded mallet	
Solvent, dry-cleaning	

7. Removal of Tubes

The only plug-in parts contained in Speech Amplifier BC–614–(*) are tubes V101, V102, V103, V104, V105, V106, and V107. Speech Amplifier BC–614–E contains tube V108 in addition.

Caution: Before the rectifier tube, V107, can be removed, the tube clamp must be loosened by opening the hold-on screw. To remove tubes first loosen thumb screws and remove chassis from rack, then pull out all tubes. (For location of tubes, see figs. 4 and 5.)

8. Cleaning, Inspection, and Lubrication

Check the set for cleanliness inside and outside, and observe the condition of the finish. Both paint and plating should be free of corrosion, blister, flaking, bare or worn spots, or deep scratches.

a. Chassis Cleaning. To get rid of dust and gravel use compressed air hose, making sure that the source of compressed air is clean and dry. To remove any accumulated grease or oil, use cloth dampened in dry-cleaning solvent (SD). For rough or blistered spots use #0000 sandpaper.

b. Chassis Inspection. Note condition of the meter. The glass should not be cracked, chipped, or broken. Determine the condition of all sockets. They should be in such condition that the connectors can engage easily and be held securely assuring positive contact. Inspect relay jack and switch contacts carefully for evidence of pitting or burning. All gaskets should be free from holes or tears. Determine the condition of the moisture-proofing. Examine touch-up of breaks for necessary resealing. Rotate carbon and dynamic microphone gain controls, they should be smooth in operation across the area of rotation. There should be very little backlash or slipping. Try all switches. They should snap firmly into contact position. The catch clasps fastening the speech amplifier to the base should snap closed and hold firmly. All nuts and screws should be tight. Check condition of wiring, note especially all soldered connections to make certain that they are secure.

c. Lubrication. The speech amplifier requires no lubrication.

d. Tube Inspection and Cleaning. Check tube envelopes to be sure that they are firmly attached to the base. Replace any tubes which have loose envelopes. Examine the glass envelope and tube base of each tube for cracks. See that the

pins are firmly attached and straight, and also see that they have a good contact surface. Inspect envelopes of tubes for dust, dirt, and oil. Inspect metal tubes and caps for dirt and corrosion. Clean tubes only when it is necessary. Use a clean dry cloth on the entire assembly. Glass envelopes may be wiped with a cloth moistened with water, and then polished with a clean dry cloth. Do not use water on metal. If tube is of glass, moisten cloth with clear water and clean envelope. After envelope is cleaned, dry with cloth. Clean around pins of tube with a small brush dipped in dry-cleaning solvent (SD) and dry with cloth.

e. Tube Testing. Plug the tube into the proper socket on the tube tester and test for shorts in accordance with the instructions provided with the tube tester. If there is no provision on the tube tester for testing shorts, tap tube while testing emission. If meter reading fluctuates, replace tube. Test tube emission by placing tube in a dynamic type tube tester. Adjust controls according to the instructions accompanying the tester. If the emission of a tube is less than one-half rated value (good) discard the tube. However, a tube which tests good in the tube tester may be unsatisfactory in the amplifier circuit. If further investigation indicates that the tube may be the source of trouble, test the tube by comparing its performance with that of a good tube of the same type.

SECTION IV

PRELIMINARY TROUBLE-SHOOTING PROCEDURES

9. Input Resistance Measurement

Note. Make the following tests with the input power disconnected and the tubes removed.

a. Connect a sensitive ohmmeter between terminals 1 and 3 of socket SO104 (SO103 in BC–614–E). With ohmmeter set on lowest range, reading should be 16 ohms (figs. 24, 25, 26, and 27).

b. Connect a sensitive ohmmeter between terminal 2 on transformer T102 and the terminal of R125 which is closest to the front panel (ground side). With ohmmeter on high range, reading should be 75,000 ohms (figs. 9 and 10).

10. Operating Test

Put all tubes back and secure them in their sockets. Connect the speech amplifier to 60-cycle a-c power source of 115 volts. Make this connection to terminals 1 and 3 of socket SO104 (socket SO103 in Speech Amplifier BC–614–E). Turn power on and examine set carefully for any abnormalities, such as unusual smoking, heating, or arcing. Attach terminal leads of Loudspeaker LS–3 or equivalent to terminals 4 and 5 of transformer T–102. Listen for hum or unusual noises. Connect a direct current (d-c) voltmeter between terminal No. 2 of transformer T–102 and terminal No. 1 of transformer T–101. Make voltage measurement on 500-volt d-c range. The input voltage measured at this point should be 250 volts, ± 10 percent.

Note. If set has been recently sprayed or touched up with moistureproofing varnish, there may be some smoke or odor present because of normal heating of varnish.

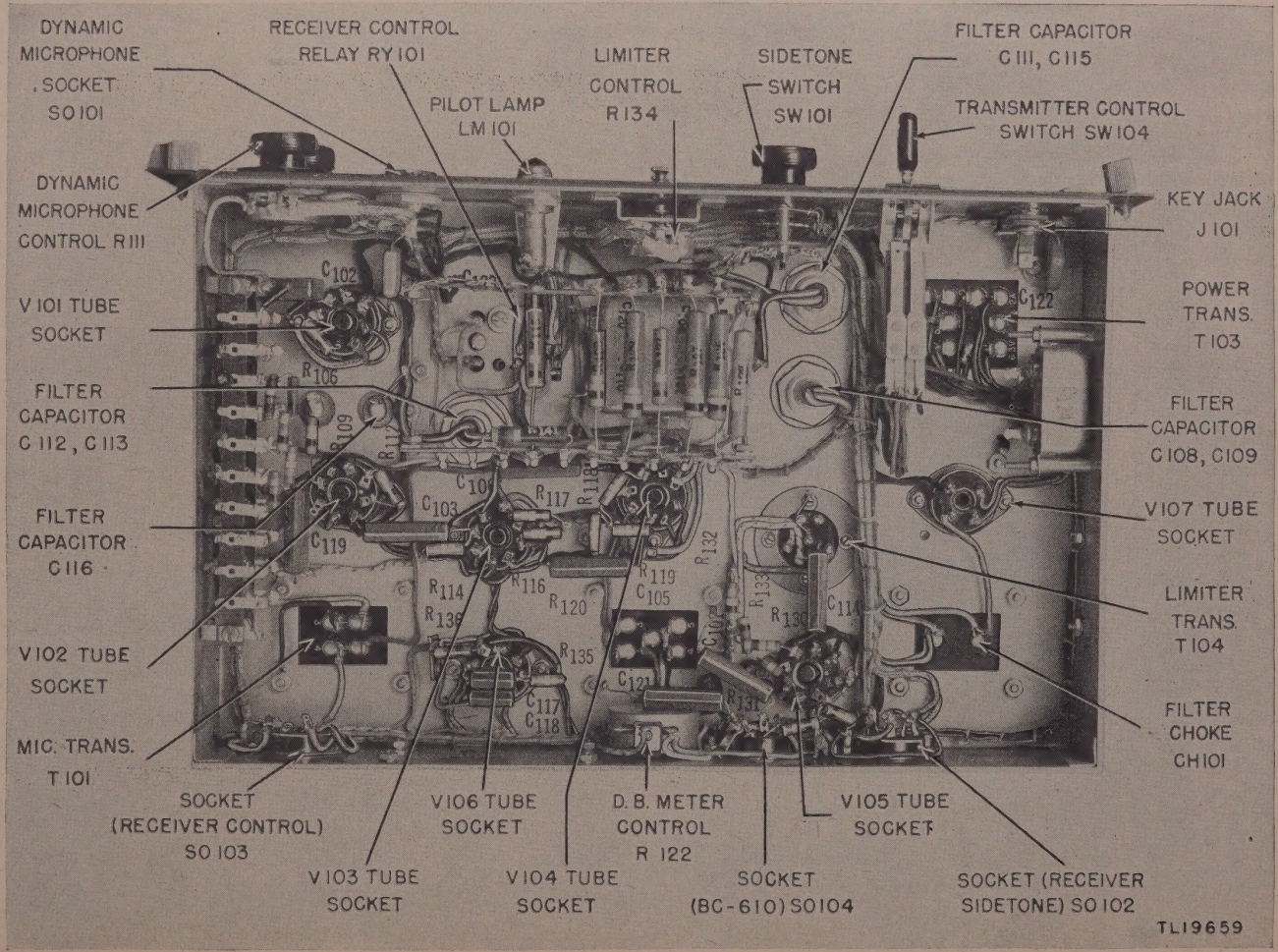


Figure 9. Speech Amplifier BC–614–A, –B, and –C, bottom view of chassis.

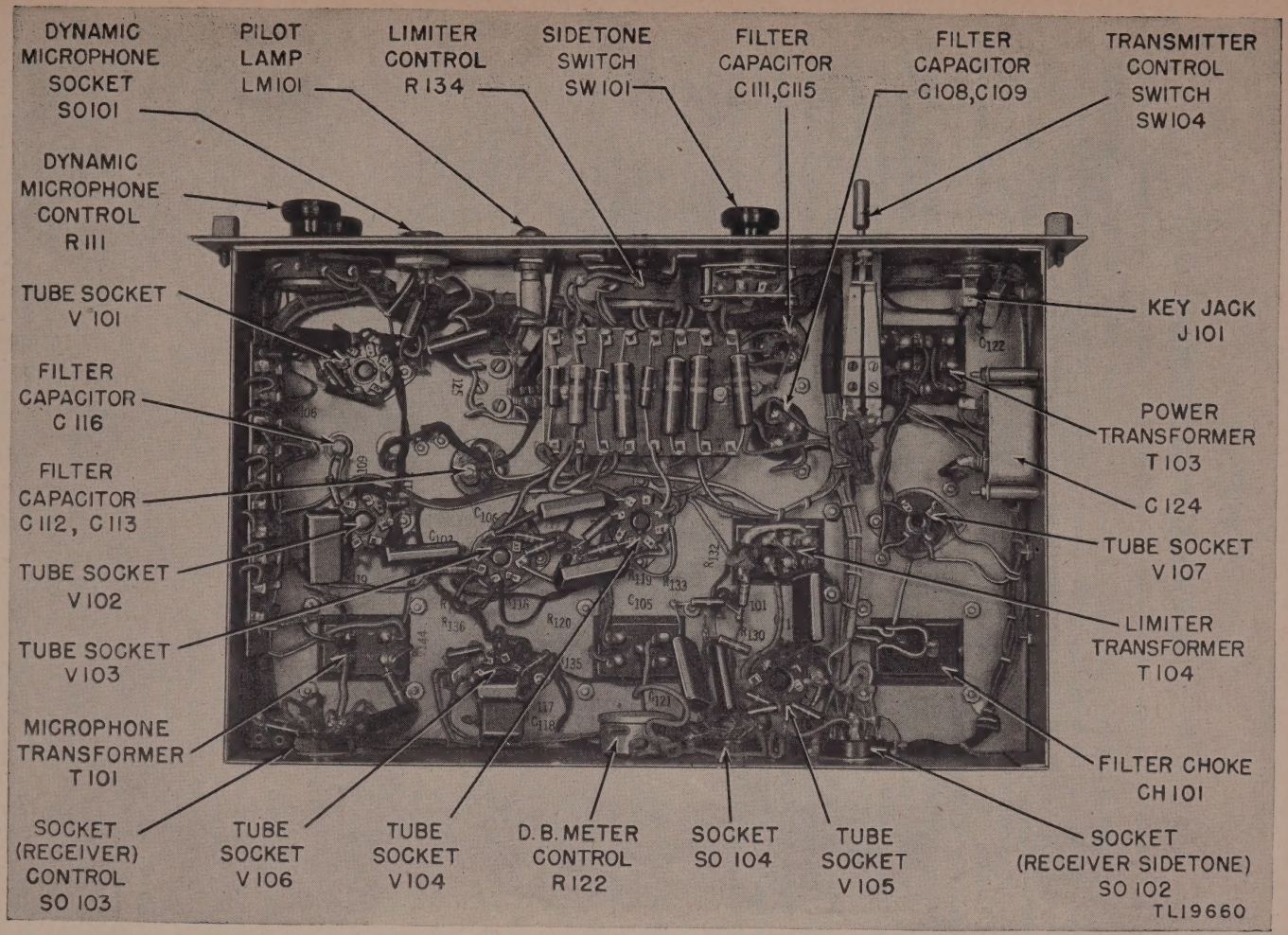


Figure 10. Speech Amplifier BC–614–D, bottom view of chassis.

SECTION V
ALIGNMENT PROCEDURE

11. Alignment of Limiter

The modulation limiter is set to provide a minimum of 3 decibels (db) compression at 100 percent modulation. Adjustment of the modulation limiter control is accomplished as follows:

a. Connect the speech amplifier and Radio Transmitter BC–610 for operation. Set the transmitter control switch of the speech amplifier to TRANS. OFF, and PLATE POWER switch on transmitter to OFF.

b. Set SIDETONE switch at OFF.

c. Remove metal plate covering the MOD. LIMITER screw adjustment control.

d. Turn the MOD. LIMITER control to the extreme left. Set CW-PHONE switch on the transmitter on PHONE.

e. Apply 400 cycles output from an audio oscillator between the ground and input terminals of either microphone jack.

f. Adjust microphone (MIC.) gain control or audio oscillator output until MODULATOR PLATE meter reads 225 milliamperes (ma), on BC–610–( ).

g. Turn MOD. LIMITER screw adjustment control to the right until MODULATOR PLATE meter reading decreases to 160 ma. The modulation limiter has now been adjusted for normal operation. Put the metal plate back over the MOD. LIMITER screw and secure firmly.

Note. This adjustment can be accomplished only if BC–610–(*) (figs. 7 and 8) is available and connected to or worked in conjunction with the speech amplifier.

SECTION VI
DETAILED TROUBLE-SHOOTING PROCEDURES

12. Signal Tracing

a. Connect the output of the audio oscillator to terminals No. 3 and No. 1 of socket SO101 (figs. 24, 25, 26, and 27) and adjust the oscillator for a frequency of 400 cycles and minimum output.

b. Connect the vacuum-tube voltmeter (VTVM) test prod to pin No. 2 through a 0.05-microfarad (mf) capacitor and connect the ground prod to ground of the chassis. (Do not hold or touch tip of prod when making tests. This may give an erroneous reading.)

c. Adjust output attenuator of test oscillator so that VTVM shows slight deflection of needle.

d. Connect the VTVM test prod to pin No. 6 of tube V101 (plate). The VTVM should now show increased needle deflection.

e. Tabulate new position of VTVM.

f. Connect the VTVM test prod to pin No. 5 of tube V102 (grid). Adjust DYNAMIC MIC. volume control to maximum gain position. VTVM needle should now deflect to the same point as in *e* above. If VTVM needle does not deflect, either capacitor C102 or C119 is probably open.

g. Connect the VTVM test prod to pin No. 3 of tube V102 (plate). The VTVM reading should now show definite increase. Return the same VTVM reading as in *f* above. If the VTVM cannot be returned to the same position as in *f* above by adjusting the level or attenuator control of the audio oscillator, turn the multiplier switch to the next highest multiplier at which it can be made to assume the same position. If the VTVM does not show any deflection, a defective tube V102 or defective circuit components in the second audio-frequency (a-f) stage may be causing the loss of signal.

h. Place the VTVM test prod on pin No. 1 (grid) of tube V103. The VTVM needle should now be in the same position as in *g* above. If the VTVM needle fails to show any deflection, coupling capacitor C103 is probably open.

i. Place the VTVM test prod on pin No. 4 (grid) of tube V103. The VTVM needle should now be in the same position as in *g* above.

j. Place the VTVM test prod on pin No. 2 (plate) of tube V103. The VTVM reading should now show a definite increase. If the VTVM does not show any deflection, this indicates a defective tube V103 or defective components in the V103 stage. Return the VTVM to the same reading as in *i* above by adjusting the audio oscillator level or attenuator control.

k. Place the VTVM test prod on pin No. 5 (plate) of tube V103. The VTVM needle should now be in the same position as in *j* above.

l. Place the VTVM test prod on pin No. 1 (grid) of tube V104. The VTVM needle should now be in the same position as in *k* above. If the VTVM needle fails to show any deflection, either coupling capacitor C106 or C105 is probably open.

m. Place the VTVM test prod on pin No. 4 (grid) of tube V104. The VTVM needle should now be in the same position as in *l* above.

n. Place the VTVM test prod on pin No. 2 (plate) of tube V104. The VTVM reading should now show an increase. If it does not do so, a defective tube V104 or defective components in the V104 stage are indicated. Return the VTVM to the same reading as in *m* above, by rotating the attenuator or level control knob.

o. Place the VTVM prod on pin No. 5 (plate) of tube V104. The VTVM needle should now be in the same position as in *n* above.

Note. In making the above test an indication of increased strength is to be expected as the signal is traced from input to output. At any point in the speech amplifier where the signal is lost or is decreased in strength, a defective stage is indicated. The exact defect in the particular stage can then be located by a voltage and resistance analysis of the stage. (See figs. 23, 24, 25, and 26.)

13. Voltage and Resistance Measurements

Figures 11 and 12 show the voltage and resistance values at the tube sockets. In making the resistance measurements, remove all tubes and plugs; set the transmitter control switch at TRANS. OFF (BC–614–E does not have this switch); set the SIDETONE switch at ON BC–342 (BC–614–E does not have this switch); set the NORMAL-REMOTE TELEPHONE at NORMAL (applies to BC–614–D and BC–614–F only); set both GAIN controls at full gain and both RECEIVER CONTROL switches at AUTO (applies

to all models except BC–614–E, which does not contain these switches). All socket measurements are to chassis ground and all transformer resistances are d-c resistances. In making the voltage measurements all readings should be taken on the lowest suitable range of a 1,000 ohms-per-volt voltmeter. All voltages are direct current to chassis unless otherwise stated. The line voltage should be approximately 117 volts alternating current. Apply the voltage across pins No. 1 and No. 3 of socket SO104 of BC–614–A, –B, –C, –D, and –F, and across pins No. 1 and No. 3 of socket SO103 in BC–614–E. If power is obtained from transmitter BC–610–(*), set the transmitter control switch of the speech amplifier at TRANS. OFF; the FILAMENT POWER switch of the transmitter at ON; and the PLATE POWER switch of the transmitter in the OFF position. The SIDETONE switch of the speech amplifier may be set at either ON BC–342 or ON BC–312. When measuring the voltages at pins of tube V106, connect cathode resistor R136 to ground on the side of the resistor not connected to pins No. 3 and No. 6.

14. Refinishing, Moistureproofing, and Fungiproofing

a. Painting and Refinishing. Where the finish on the case has been badly scarred or damaged, rust and corrosion can be prevented by touching up the bared surface of the case as follows:

(1) Remove all rough spots, using #0000 sandpaper, and clean surface down to metal, obtaining a bright smooth finish.

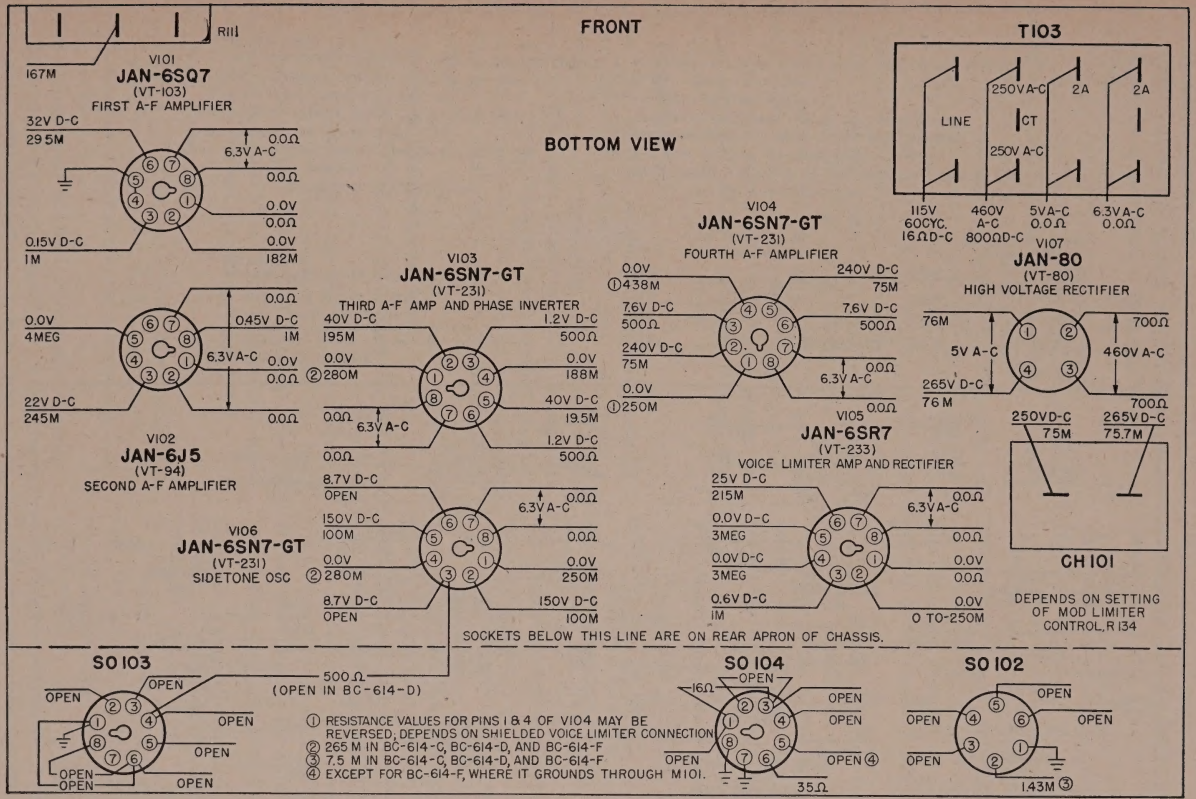
Caution: The use of steel wool, while it does permit quick removal of rust is not recommended. The use of steel wool allows small particles of the metal to enter the case and damage the equipment by causing internal electrical shorting or grounding of circuits.

(2) Rust may be removed from the case by first cleaning the corroded metal with dry-cleaning solvent (SD). In severe cases, it may be necessary to use dry-cleaning solvent (SD) to soften up the rust, and sandpaper to complete the preparation for painting.

(3) Touch up small parts by applying paint with a small brush. Where the case has so many scars and scratches as to warrant repainting, remove the chassis from case and spray-paint the entire case. The paint applied shall be of the quality authorized by existing regulations.

(4) Accomplish the above procedures in accordance with accepted shop practices.

b. Moistureproofing and Fungiproofing. Apply moistureproofing and fungiproofing varnish to repaired connections and all parts from which the coating was removed. If more than 6 months has elapsed since moistureproofing and fungiproofing varnish was last applied, repeat the entire process in accordance with TB SIG 13, Moistureproofing and Fungiproofing Signal Corps Equipment.



RESISTANCE MEASUREMENTS

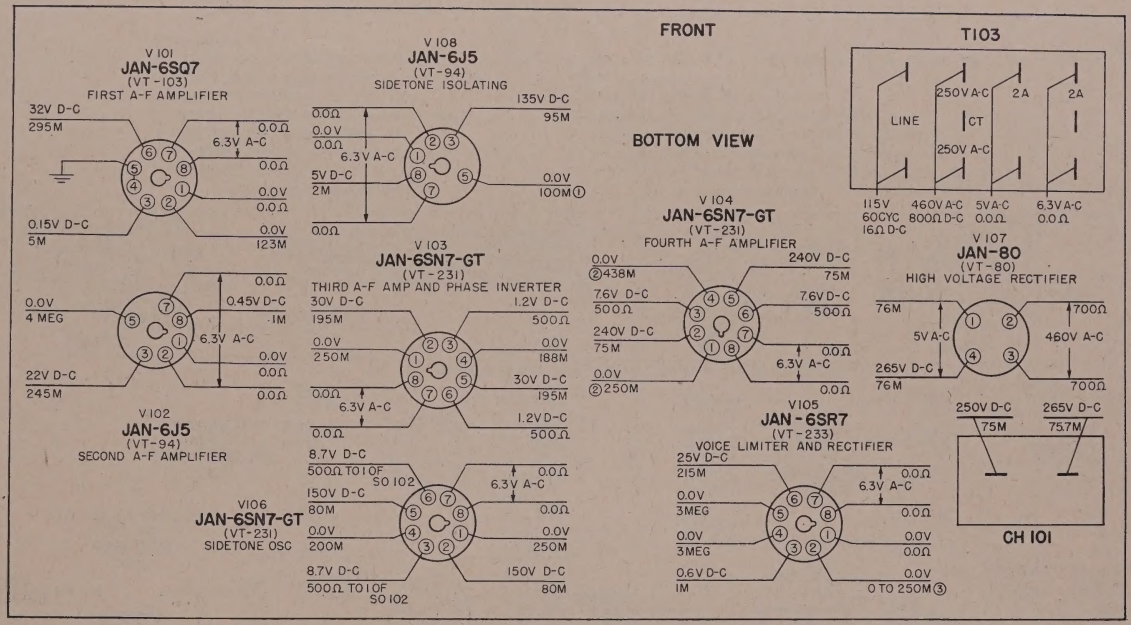
1. ALL TUBES REMOVED.
2. TRANSMITTER CONTROL SWITCH AT TRANS OFF.
3. SIDETONE SWITCH AT ON BC-342.
4. NORMAL-REMOTE PHONE SWITCH AT NORMAL.
5. BOTH GAIN CONTROLS AT FULL GAIN.
6. BOTH RECEIVER CONTROL SWITCHES AT AUTO.
7. ALL SOCKET MEASUREMENTS MADE TO CHASSIS GROUND.
8. M = 1000 OHMS.

VOLTAGE MEASUREMENTS

1. MEASUREMENTS MADE WITH 1000 OHMS-PER-VOLT METER.
2. A-C LINE VOLTAGE APPROXIMATELY 117 VOLTS.
3. ALL MEASUREMENTS MADE TO CHASSIS GROUND.
4. TRANSMITTER CONTROL SWITCH AT TRANS OFF.
5. FILAMENT POWER SWITCH ON.
6. PLATE POWER SWITCH OFF.
7. SIDETONE SWITCH AT EITHER ON BC-342 OR ON BC-312.

TL 19661

Figure 11. Speech Amplifier BC-614-A, -B, -C, -D, and -F, tube socket layout diagram.



① R137 SET AT MAXIMUM.

② RESISTANCE VALUES FOR PINS 1&4 OF V104 MAY BE REVERSED, DEPENDS ON SHIELDED VOICE LIMITER CONNECTION.

③ DEPENDS ON SETTING OF R134.

ALL RESISTANCE VALUES APPROXIMATE 10% TOLERANCE.

RESISTANCE MEASUREMENTS

1. ALL TUBES REMOVED.
2. TRANSMITTER CONTROL SWITCH AT TRANS OFF
3. SIDETONE SWITCH AT ON BC-342.
4. NORMAL-REMOTE PHONE SWITCH AT NORMAL.
5. BOTH GAIN CONTROLS AT FULL GAIN.
6. BOTH RECEIVER CONTROL SWITCHES AT AUTO.
7. ALL SOCKET MEASUREMENTS MADE TO CHASSIS GROUND.
8. M = 1000 OHMS.

VOLTAGE MEASUREMENTS

1. MEASUREMENTS MADE WITH 1000 OHMS-PER-VOLT METER
2. A-C LINE VOLTAGE APPROXIMATELY 117 VOLTS.
3. ALL MEASUREMENTS MADE TO CHASSIS GROUND.
4. TRANSMITTER CONTROL SWITCH AT TRANS OFF.
5. FILAMENT POWER SWITCH ON.
6. PLATE POWER SWITCH OFF.
7. SIDETONE SWITCH AT EITHER ON BC-342 OR ON BC-312.

TL 19662

Figure 12. Speech Amplifier BC-614-E, tube socket layout diagram.

SECTION VII
FINAL TESTING

15. Audio Output Test

a. Place a 500-ohm, ½-watt resistor load across the secondary of transformer T102 (terminals No. 4 and No. 5).

b. Connect a VTVM across the resistor.

c. Connect the audio oscillator to the dynamic microphone socket S0101 (ground lead to terminal No. 1, output lead to terminal No. 3).

d. Adjust the audio oscillator to a frequency of 400 cycles per second (cps) and slowly adjust DYNAMIC MIC. GAIN control until VTVM reads 8.68 volts (6.9 volts in BC–614–E). If a decibel meter is available, the input to the speech amplifier from the audio oscillator should be adjusted to —40 db (—26 db in BC–614–E) before checking output voltage. Inability to get required VTVM reading indicates insufficient output. In this case check individual stages to localize trouble. Make necessary repairs and repeat test.

16. Distortion Test

After the speech amplifier has satisfactorily passed the audio output test (par. 15), make a distortion test. To make this test, connect oscilloscope vertical leads to terminals No. 4 and No. 5 of T102. A smooth sine wave should appear on the oscilloscope screen. Any marked distortions appearing on oscilloscope should be localized to individual stage.

17. Sidetone Output Level Test

a. Set SIDETONE switch to either ON BC–312 or ON BC–342.

b. The output of the sidetone oscillator should be 3.46 volts (+6 db) measured across the 500-ohm resistance placed between terminals No. 4 and No. 5 of transformer T102. (This test does not apply for Speech Amplifier BC–614–E.)

18. Hum Level Test

a. Place a 250,000-ohm, ½-watt across terminals No. 1 and No. 3 of socket S0101 and a 200-ohm ½-watt resistance across carbon microphone jack J102.

b. Set both audio GAIN controls at maximum.

c. The output across terminals No. 4 and No. 5 of transformer T102 should be no more than 0.0548 volts (—30 db) measured with an a-c VTVM.

19. Compression Test

a. Place a 500,000-ohm ½-watt resistor across terminals No. 1 and No. 3 of socket SO101 and a 200-ohm, ½-watt across the carbon-microphone terminals of jack J102.

b. Connect the audio oscillator to the 500,000-ohm resistor placed across terminals No. 1 and No. 3 of SO101.

c. Adjust the audio oscillator for an output of —42 db (0.01 volt) at 400 cps; adjust the audio controls of Speech Amplifier BC–614–(*) so that an output of +12 db (6.9 volts) is measured across the 500-ohm resistor connected across the secondary of transformer T102 (terminals No. 4 and No. 5).

d. By means of the compression control it should be possible to reduce the output to +6 db.

e. Repeat the above procedure with the input across the 200-ohm resistor placed across the carbon-microphone jack.

20. Aural Functional Test

a. Place a felt or rubber pad under the speech amplifier.

b. Connect a Loudspeaker LS–3, or equivalent, across terminals No. 4 and No. 5 of transformer T102.

c. Connect a source of 117-volt, a-c power to the speech amplifier.

d. Plug Microphone T–50 (or equivalent dynamic microphone) into socket S101.

e. Speak into the microphone and listen to the quality of speech on LS–3. The output should be clear and undistorted.

f. Tap speech amplifier with a padded mallet while continuing to speak into microphone. Output should remain clear and undistorted. Watch particularly for shutting off of output or noises that might be due to loose connections.

Caution: Do not strike speech amplifier forcibly enough to disable it. Tapping the equipment gently is sufficient for the purposes of this test.

g. While speaking into the microphone rotate the DYNAMIC MIC. GAIN control. Gain should be even and proportional for all positions of control.

h. Repeat the entire test using Microphone T–30 (or equivalent carbon microphone) instead of the dynamic microphone and inserting it into jack J102. Rotate CARBON MIC. GAIN control. Gain should be even and proportional for all positions of control.

SECTION VIII

INDIVIDUAL STAGE AND CIRCUIT REPAIR DATA

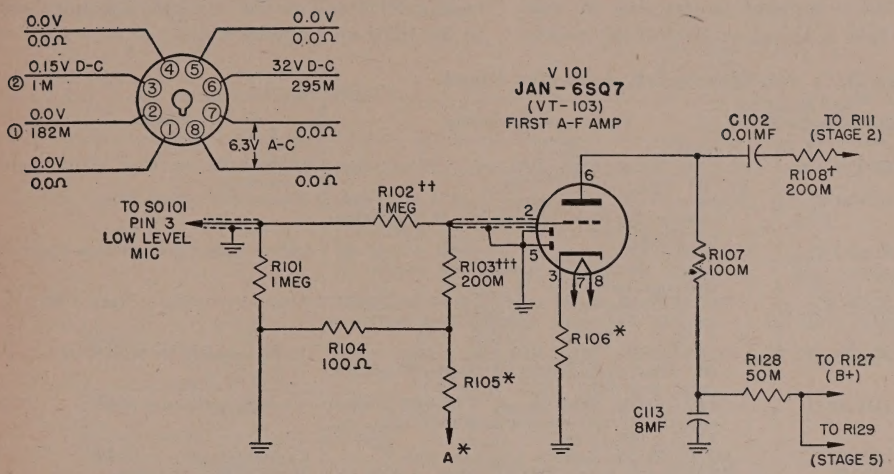
21. First A-F Amplifier Stage

a. Special Circuit Feature (fig. 13). The audio-frequency voltage from microphone T–50–(*) (dynamic microphone) enters the amplifier at terminal No. 3 of Socket SO101, passes through the attenuating network composed of resistors R101, R102, R103, and R104, and is fed to the grid of microphone input amplifier tube V101. When the transmitter is modulated by means of a local or remote telephone, the current enters the speech amplifier at terminal No. 5 of socket SO103 (Terminal No. 3 of socket SO102 in BC–614–E) passes through switch SW104 (not in model BC–614–E), resistor R105, the attenuating network, and is fed to the grid of microphone input amplifier tube V101. The attenuating network permits this telephone input to be connected to the same grid circuit that is connected to the dynamic microphone without upsetting the impedance termination of either one. This network also adjusts the voltage at the grid of tube V101 to the proper value in either case. Plate voltage is applied to tube V101 through the filter consisting of resistor R128 and capacitor C113. Grid bias for tube V101 is obtained by the voltage drop across cathode resistor R106. The output voltage of tube V101 appears across plate resistor R107 and passes through coupling capacitor C102 to the second a-f amplifier stage.

b. Parts Data for First A-F Amplifier Stage.

Ref symbol	Signal Corps stock No.	Name of part and description	Function
C102	3DA10–128	CAPACITOR, fixed: 0.01 mf, ±20%; mica; 600 vdcw; type MP–4134.	Tube V101 to tube V102, audio coupling.
C113	3DB8–35	CAPACITOR, fixed: 8 mf, −10 +40%; electrolytic; 475 vdcw; special; dual unit; see C112.	Audio decoupling for tube V101.
R101	3Z6801–16	RESISTOR, fixed: 1,000,000 ohms; ±20%; ½ watt; type BT–½.	Gain dividing component at grid of tube V101.
R102	3Z6801–16	Same as R101	Gain dividing component at grid of tube V101.
R102 E*	3Z4593	RESISTOR: 3 meg; ±10%; ½ watt carbon type BT–½.	Gain dividing component at grid of tube V101.
R103	3Z4548	RESISTOR, fixed: 200,000 ohms, ±10%, ½ watt; type BT–½.	Gain dividing component at grid of tube V101.
R103 E*	3Z4550	RESISTOR: 100,000 ohms, ±10%, ½ watt; carbon; type BT–½.	Gain dividing component at grid of tube V101.
R104	3Z6010–18	RESISTOR, fixed: 100 ohms, ±10%, ½ watt; type BT–½.	Gain dividing component of tube V101.
R105	3Z4528	RESISTOR, fixed: 5,000 ohms, ±10%, ½ watt; type BT–½.	Gain dividing component at grid of tube V101.
R105 E*	3Z6625–37	RESISTOR: 25,000 ohms, ±10%, ½ watt; carbon.	Gain dividing component at grid of tube V101.
R106	3Z4525	RESISTOR, fixed: 1,000 ohms, ±10%, ½ watt; type BT–½.	Cathode bias for tube V101.
R106 E*	3Z4528	RESISTOR, fixed: 5,000 ohms, ±10%, ½ watt; type BT–½.	Cathode bias for tube V101.
R107	3Z4550	RESISTOR, fixed: 100,000 ohms, ±10%, ½ watt; type BT–½.	Plate resistor for tube V101.
R128	3Z6650–8	RESISTOR, fixed: 50,000 ohms, ±10%, 1 watt; type BT–1 (Model E, type A–1).	Audio decoupling for tube V101.
V101	2T103	TUBE: duo-diode triode; JAN–6SQ7 (VT–103)	A-f amplifier.

*Applies only to model indicated.



*

MODEL	R105	R106	A
BC-614-A	5M	1M	SW104
BC-614-B	5M	1M	SW104
BC-614-C	5M	1M	SW104
BC-614-D	5M	1M	SW105B,ARM
BC-614-E	25M	5M	SO102,PIN3
BC-614-F	5M	1M	SW105B,ARM

† NOT INCLUDED IN BC-614-E
†† 3MEG IN BC-614-E
††† 100M IN BC-614-E

① 123M IN BC-614-E
② 5M IN BC-614-E

RESISTANCE MEASUREMENTS

1. ALL TUBES REMOVED.
2. TRANSMITTER CONTROL SWITCH AT TRANS OFF.
3. SIDETONE SWITCH AT ON BC-342.
4. NORMAL-REMOTE PHONE SWITCH AT NORMAL.
5. BOTH GAIN CONTROLS AT FULL GAIN.
6. BOTH RECEIVER CONTROL SWITCHES AT AUTO.
7. ALL SOCKET MEASUREMENTS MADE TO CHASSIS GROUND.
8. M = 1000 OHMS.

VOLTAGE MEASUREMENTS

1. MEASUREMENTS MADE WITH 1000 OHMS-PER-VOLT METER.
2. A-C LINE VOLTAGE APPROXIMATELY 117 VOLTS.
3. ALL MEASUREMENTS MADE TO CHASSIS GROUND.
4. TRANSMITTER CONTROL SWITCH AT TRANS OFF.
5. FILAMENT POWER SWITCH ON.
6. PLATE POWER SWITCH OFF.
7. SIDETONE SWITCH AT EITHER ON BC-342 OR ON BC-312.

NOTE: ⊣⊢ IS SYMBOL FOR FIXED CAPACITOR.

TL 19663

Figure 13. Speech Amplifier BC-614-A, -B, -C, -E, and -F, first a-f amplifier stage.

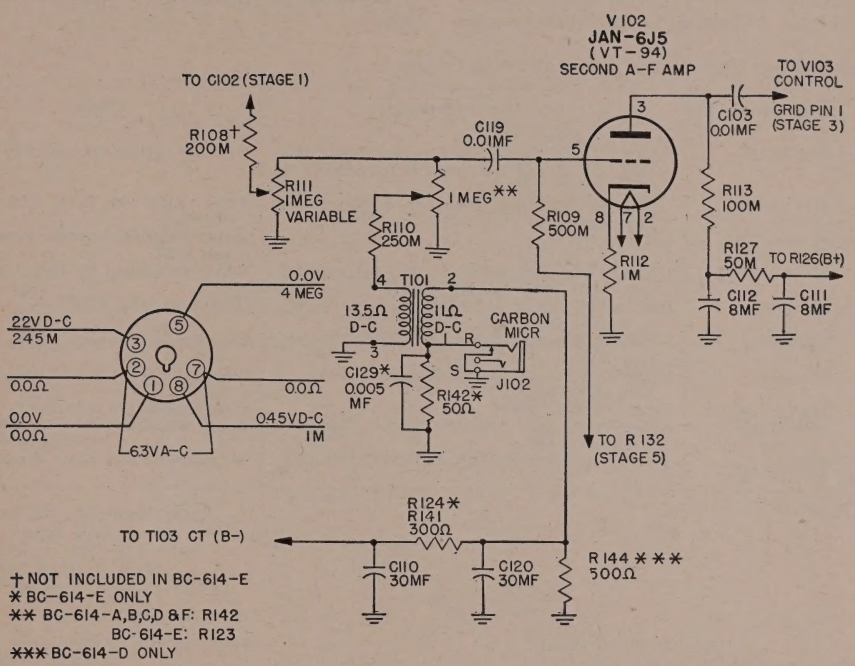
22. Second A-F Amplifier Stage

a. Special Circuit Features (fig. 14). The output from tube V101 is fed to the grid of the second voltage amplifier V102 after passing through R108, the arm of gain control R111, and capacitor C119. B+voltage which has passed through the filter consisting of resistor R127 and capacitor C112 is supplied to the plate of tube V102. The tube is biased partly through resistor R109 from the speech limiting rectifier and partly by the drop across resistor R112 which is in the cathode circuit. When the carbon microphone is in use, the input voltage enters the speech amplifier through jack J102, passes through T101, resistor R110, the arm of carbon-microphone gain control R142 and is fed to the grid of tube V102. The amplified speech voltages appear across plate resistor R113 and are fed through capacitor C103 to the third a-f amplifier stage.

b. Parts Data for Second A-F Amplifier Stage.

Ref symbol	Signal Corps stock No.	Name of part and description	Function
C103	3DA10–128	CAPACITOR, fixed: 0.01 mf, ±20%; mica; 600 vdcw; type MP–4134.	Tube V102 to tube V103 audio coupling.
C110	3DB30–5	CAPACITOR, fixed: 30 mf, −10 +40%; electrolytic; 25 vdcw; special; one of four units; see C104, C107, C120.	Microphone voltage filter.
C110 E*	3DB10–21	CAPACITOR, fixed: 30 mf, −10 +75%; 25 vdcw; electrolytic; special; one section of four units; see C104.	Carbon microphone voltage filter.
C112	3DB8–35	CAPACITOR, fixed: 8 mf, −10 +40%; electrolytic; 475 vdcw; special; dual unit; see C113.	Audio decoupling for tube V102.
C119	3DA10–128	CAPACITOR, fixed: 0.01 mf, ±20%; mica; 600 vdcw; type MP–4134; (Model E molded paper type 342.)	Audio coupling for tube V102.
C120	3DB10–21	CAPACITOR, fixed; 30 mf, −10 +75% electrolytic; 25 volt d-c; (special four units, see C104, C107, C110).	Microphone voltage filter.
J102	2Z5522	JACK, JK–22: 3-circuit telephone type	Carbon microphone input.
R108	3Z4548	RESISTOR, fixed: 200,000 ohms, ±10%, ½ watt; type BT–½.	Mixer isolating resistor.
R109	3Z4533	RESISTOR, fixed: 500,000 ohms, ±10%; ½ watt; type BT–½.	Mod limiter isolating resistor.
R110	324562	RESISTOR, fixed: 250,000 ohms, ±10%; ½ watt; type BT–½.	Mixer isolating resistor.
R111	2Z7298–3	RESISTOR, variable: 1 megohm, ±20%; special.	Low level gain control.
R112	3Z4525	RESISTOR, fixed: 1,000 ohms, ±10%; ½ watt; type BT–½.	Cathode bias for tube V102.
R112 E*	3Z4528	RESISTOR: 5,000 ohms, ±10%; ½ watt; carbon.	Cathode bias for tube V102.
R113	3Z4550	RESISTOR, fixed: 100,000 ohms, ±10%; ½ watt; type BT–½.	Plate resistor for tube V102.
R127	3Z6650–7	RESISTOR, fixed: 50,000 ohms, ±10%; 2 watts; type BT–2.	Audio decoupling for tube V102.
R127 E*	3Z6650–8	RESISTOR: 50,000 ohms, ±10%; 1 watt	Audio decoupling for tube V102.
R141	3Z6030–11	RESISTOR, fixed: 300 ohms, ±10%; 1 watt; type BW–1.	Microphone voltage filter.
R141 E*	3Z4528	RESISTOR, fixed: 5,000 ohms, ±10%; ½ watt; type BT–½.	Decoupling resistor for sidetone output.
R142	2Z7298–3	RESISTOR, variable: 1 megohm, ±20%; special.	Carbon microphone gain control.
R142 E*	3Z6005–44	RESISTOR: 50 ohms ±10%; ½ watt	Carbon microphone shunt.
R144 D*	3Z6050–21	RESISTOR, fixed: 500 ohms, ±10%; 1 watt; type BT–1.	Microphone bleeder (supply).
T101	2Z9631.3	TRANSFORMER: Pri impedance 1250 ohms; sec impedance 125 ohms; type 2D131.	Carbon microphone to tube V102 grid.
V102	2T94	TUBE: triode; JAN–6J5 (VT–94)	A-f amplifier.

*Applies only on model indicated.



RESISTANCE MEASUREMENTS.

1. ALL TUBES REMOVED.
2. TRANSMITTER CONTROL SWITCH AT TRANS OFF.
3. SIDETONE SWITCH AT ON BC-342.
4. NORMAL-REMOTE PHONE SWITCH AT NORMAL.
5. BOTH GAIN CONTROLS AT FULL GAIN.
6. BOTH RECEIVER CONTROL SWITCHES AT AUTO.
7. ALL SOCKET MEASUREMENTS MADE TO CHASSIS GROUND.
8. M = 1000 OHMS.

VOLTAGE MEASUREMENTS

1. MEASUREMENTS MADE WITH 1000 OHMS-PER-VOLT METER.
2. A-C LINE VOLTAGE APPROXIMATELY 117 VOLTS.
3. ALL MEASUREMENTS MADE TO CHASSIS GROUND.
4. TRANSMITTER CONTROL SWITCH AT TRANS OFF.
5. FILAMENT POWER SWITCH ON.
6. PLATE POWER SWITCH OFF.
7. SIDETONE SWITCH AT EITHER ON BC-342 OR ON BC-312.

NOTE: ⊣⊢ IS SYMBOL FOR FIXED CAPACITOR.

TL 19664

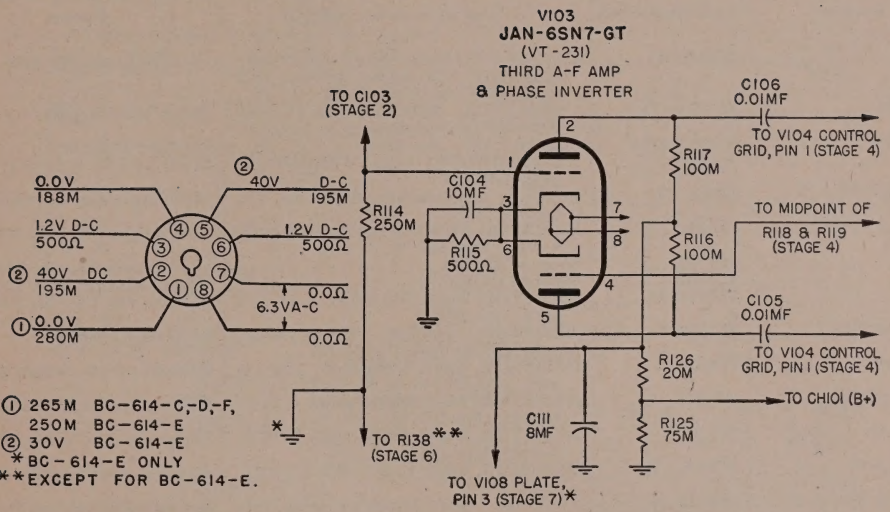
Figure 14. Speech Amplifier BC-614-A, -B, -C, -D, -E, and -F, second a-f amplifier stage.

23. Third A-F Amplifier Stage

a. Special Circuit Features (fig. 15). The output from tube V102 is fed to the grid of dual triode tube V103. The plate voltage is supplied to the tube through the filter consisting of resistor R126 and capacitor C111. The output voltage from one triode section appears across plate resistor R117 and is fed through coupling capacitor C106 to the grid of tube V104 in the fourth a-f amplifier stage. A portion of the grid voltage appears across resistor R120 (in the fourth a-f stage) as a result of a voltage drop through R118 (the grid leak resistor for tube V104) and is fed back to the second grid of tube V103. Here it is amplified and appears in proper phase across plate resistor R116. It is fed through coupling capacitor C105 to the grid of tube V104 in the fourth a-f stage. The grid bias of tube V103 is obtained from the voltage drop across cathode resistor R115 which is bypassed by cathode capacitor C104.

b. Parts Data for Third A-f Amplifier Stage.

Ref symbol	Signal Corps stock No.	Name of part and description	Function
C104	3DB10–21	CAPACITOR, fixed: 10 mf −10 +75%; electrolytic; 25 volt d-c; special four units, see C107, C110, C120.	Cathode bypass for tube V103.
C105	3DA10–128	CAPACITOR, fixed: 0.01 mf, ±20%; mica; 600 vdcw; type MP–4134.	Tube V103 to tube V104 audio coupling.
C106	3DA10–128	Same as C105	Audio coupling between tubes V103 and V104.
C111	3DB8–35	CAPACITOR, fixed: 8 mf, −10 +40%; electrolytic; 475 vdcw; special; dual unit; see C115.	Audio decoupling for tube V103.
R114	3Z4562	RESISTOR, fixed: 250,000 ohms; ±10%; ½ watt; type BT–½.	Grid resistor for V103.
R115	3Z6050–53	RESISTOR, fixed: 500 ohms, ±10%; 1 watt; type BW–1.	Cathode bias for tube V103.
R116	3Z4550	RESISTOR, fixed: 100,000 ohms, ±10%; ½ watt; type BT–½.	Plate resistor for tube V103.
R117	3Z4550	Same as R116	Plate resistor for tube V103.
R126	3Z6620–12	RESISTOR, fixed: 20,000 ohms, ±10%; 2 watts; type BT–2.	Audio decoupling for tube V103.
V103	2T231	TUBE: twin triode; JAN–6SN7GT (VT–231)	A-f amplifier and phase inverter.



RESISTANCE MEASUREMENTS

1. ALL TUBES REMOVED.
2. TRANSMITTER CONTROL SWITCH AT TRANS OFF.
3. SIDETONE SWITCH AT ON BC-342.
4. NORMAL-REMOTE PHONE SWITCH AT NORMAL.
5. BOTH GAIN CONTROLS AT FULL GAIN.
6. BOTH RECEIVER CONTROL SWITCHES AT AUTO.
7. ALL SOCKET MEASUREMENTS MADE TO CHASSIS GROUND.
8. M = 1000 OHMS.

VOLTAGE MEASUREMENTS

1. MEASUREMENTS MADE WITH 1000 OHMS-PER-VOLT METER.
2. A-C LINE VOLTAGE APPROXIMATELY 117 VOLTS.
3. ALL MEASUREMENTS MADE TO CHASSIS GROUND.
4. TRANSMITTER CONTROL SWITCH AT TRANS OFF.
5. FILAMENT POWER SWITCH ON.
6. PLATE POWER SWITCH OFF.
7. SIDETONE SWITCH AT EITHER ON BC-342 OR ON BC-312.

NOTE: ⊣⊢ IS SYMBOL FOR FIXED CAPACITOR.

TL 19665

Figure 15. Speech Amplifier BC-614-A, -B, -C, -D, -E, and -F, third a-f amplifier stage

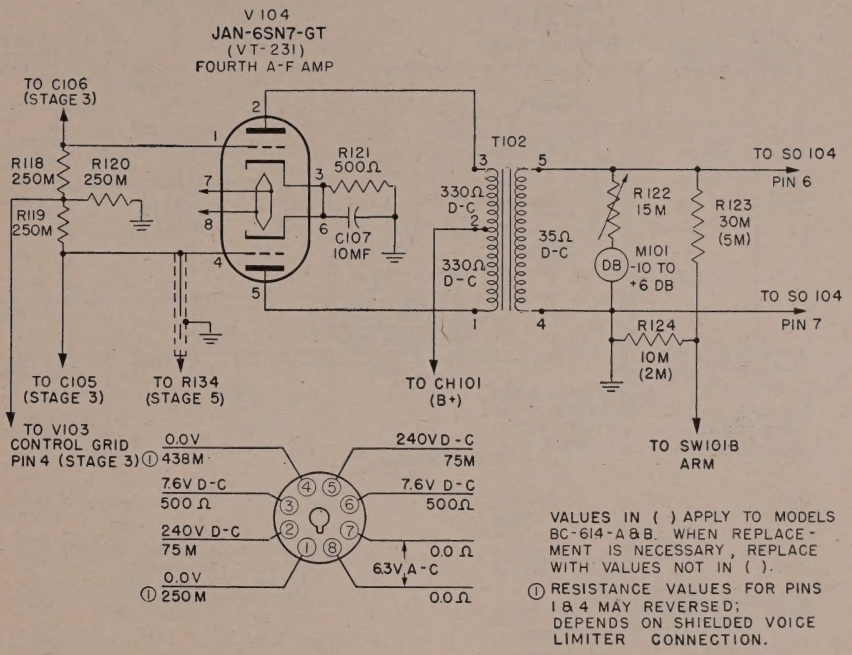
24. Fourth A-F Amplifier Stage

a. Special Circuit Features (figs. 16, 17, and 18). Tube V104 acts as a push-pull amplifier. Plate voltage is applied to the tube through transformer T102. Resistors R118 and R119 are grid leaks for the two triodes and grid bias is provided by the voltage drop across resistor R121 which is bypassed by capacitor C107. The tube output is fed to the primary of output transformer T102. The secondary of T102 is connected to a low impedance line, through which the amplified speech is fed to the transmitter, at socket SO104 (socket SO105 in BC–614–E). The relative strength of the output signal fed to the transmitter is registered on meter M101, the OUTPUT LEVER meter (MODULATOR PLATE meter in models E and F). The meter reading is adjusted by resistor R122 (except in models E and F), so that for normal speech the indicator will be roughly in the center of the scale. This adjustment is made at the factory and normally need not be touched.

b. Parts Data for Fourth A-f Amplifier Stage.

Ref symbol	Signal Corps stock No.	Name of part and description	Function
C107	3DB10–21	CAPACITOR, fixed: 10 mf; −10 +75%; electrolytic; 25 vdcw; special; four units; see C104, C110, C120.	Cathode bypass for tube V104.
C125 E*	3DA10–124.1	CAPACITOR, fixed: 0.01 mf; ±20%; 600 vdcw; moulded paper; type 342.	Meter M101 bypass.
C126 E*	3DA10–124.1	Same as C125	R-f filter on a-c line.
M101	3FS306	LEVEL METER: −10 to +6db; bakelite case; model 47.	MOD LEVEL indicator.
M101 E*, F*	3F930–10	METER: milliammeter; 0–300 ma d-c; type DO–53.	Modulator plate current meter.
R118	3Z4562	RESISTOR, fixed: 250,000 ohms, ±10%; ½ watt; type BT–½.	Grid resistor for Tube V104.
R119	3Z4562	Same as R118	Grid resistor for tube V104.
R120	3Z4562	Same as R118	Grid resistor for tube V103.
R121	3Z6050–53	RESISTOR, fixed: 500 ohms, ±10%; 1 watt; type BW–1.	Cathode bias for tube V104.
R122 ABCD*	3Z7298–5	RESISTOR, variable: 15,000 ohms, ±20%; wire-wound; type 25.	Level meter control.
R123 AB*	3Z4528	RESISTOR, fixed: 5,000 ohms, 10%; ½ watt; type BT–½.	Sidetone output divider network.
R1235 CDF*	3Z4540	RESISTOR, fixed: 30,000 ohms, ±10%; ½ watt; type BT–½.	Sidetone output divider network.
R124 AB*	3Z526	RESISTOR, fixed: 2,000 ohms, ±10%; ½-watt; type BT–½.	Sidetone output divider network.
R124 CDF*	3Z4529	RESISTOR, fixed: 10,000 ohms, ±10%; ½-watt.	Sidetone output divider network.
SW101B ABCD F*	3Z9825–34	SWITCH: S-pole; 3-position rotary, special.	Receiver sidetone switching.
T102	2Z9632.4	TRANSFORMER: pri impedance 18,000 ohms; sec impedance 500 ohms; type 2A99.	BC–614 output transformer.
V104	2T231	TUBE: twin triode; JAN–6SN7GT (VT–231).	A-f amplifier.

*Applies only to model or models indicated.



VALUES IN ( ) APPLY TO MODELS BC-614-A&B. WHEN REPLACEMENT IS NECESSARY, REPLACE WITH VALUES NOT IN ( ).

① RESISTANCE VALUES FOR PINS 1 & 4 MAY REVERSED; DEPENDS ON SHIELDED VOICE LIMITER CONNECTION.

RESISTANCE MEASUREMENTS

1. ALL TUBES REMOVED
2. TRANSMITTER CONTROL SWITCH AT TRANS OFF.
3. SIDETONE SWITCH AT ON BC-342.
4. NORMAL-REMOTE PHONE SWITCH AT NORMAL.
5. BOTH GAIN CONTROLS AT FULL GAIN.
6. BOTH RECEIVER CONTROL SWITCHES AT AUTO
7. ALL SOCKET MEASUREMENTS MADE TO CHASSIS GROUND.
8. M = 1000 OHMS

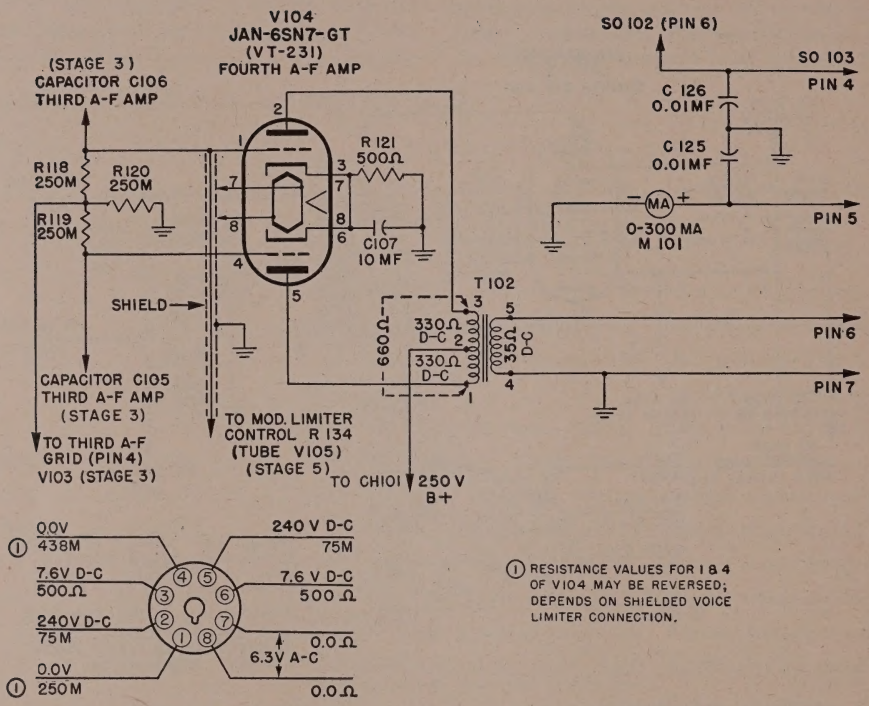
VOLTAGE MEASUREMENTS

1. MEASUREMENTS MADE WITH 1000 OHMS-PER-VOLT METER.
2. A-C LINE VOLTAGE APPROXIMATELY 117 VOLTS.
3. ALL MEASUREMENTS MADE TO CHASSIS GROUND.
4. TRANSMITTER CONTROL SWITCH AT TRANS OFF
5. FILAMENT POWER SWITCH ON.
6. PLATE POWER SWITCH OFF
7. SIDETONE SWITCH AT EITHER ON BC-342 OR ON BC-312.

NOTE ⏚ IS SYMBOL FOR FIXED CAPACITOR

TL 19666

Figure 16. Speech Amplifier BC-614-A, -B, -C, and -D, fourth a-f amplifier stage.



① RESISTANCE VALUES FOR 1 & 4 OF V104 MAY BE REVERSED; DEPENDS ON SHIELDED VOICE LIMITER CONNECTION.

RESISTANCE MEASUREMENTS

1. ALL TUBES REMOVED.
2. TRANSMITTER CONTROL SWITCH AT TRANS OFF.
3. SIDETONE SWITCH AT ON BC-342.
4. NORMAL-REMOTE PHONE SWITCH AT NORMAL.
5. BOTH GAIN CONTROLS AT FULL GAIN
6. BOTH RECEIVER CONTROL SWITCHES AT AUTO.
7. ALL SOCKET MEASUREMENTS MADE TO CHASSIS GROUND.
8. M = 1000 OHMS.

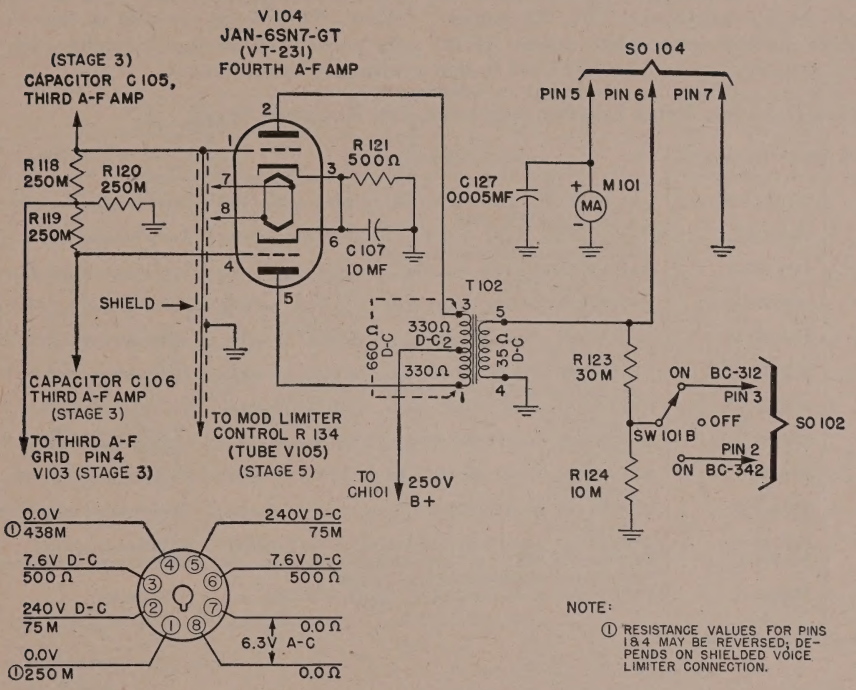
VOLTAGE MEASUREMENTS

1. MEASUREMENTS MADE WITH 1000 OHMS-PER-VOLT METER.
2. A-C LINE VOLTAGE APPROXIMATELY 117 VOLTS.
3. ALL MEASUREMENTS MADE TO CHASSIS GROUND.
4. TRANSMITTER CONTROL SWITCH AT TRANS OFF.
5. FILAMENT POWER SWITCH ON.
6. PLATE POWER SWITCH OFF.
7. SIDETONE SWITCH AT EITHER ON BC-342 OR ON BC-312.

NOTE: ⊣⊢ IS SYMBOL FOR FIXED CAPACITOR.

TL 19667

Figure 17. Speech Amplifier BC-614-E, fourth a-f amplifier stage.



RESISTANCE MEASUREMENTS

1. ALL TUBES REMOVED.
2. TRANSMITTER CONTROL SWITCH AT TRANS OFF
3. SIDETONE SWITCH AT ON BC-342.
4. NORMAL-REMOTE PHONE SWITCH AT NORMAL.
5. BOTH GAIN CONTROLS AT FULL GAIN.
6. BOTH RECEIVER CONTROL SWITCHES AT AUTO.
7. ALL SOCKET MEASUREMENTS MADE TO CHASSIS GROUND.
8. M = 1000 OHMS.

VOLTAGE MEASUREMENTS

1. MEASUREMENTS MADE WITH 1000 OHMS-PER-VOLT METER.
2. A-C LINE VOLTAGE APPROXIMATELY 117 VOLTS.
3. ALL MEASUREMENTS MADE TO CHASSIS GROUND.
4. TRANSMITTER CONTROL SWITCH AT TRANS OFF.
5. FILAMENT POWER SWITCH ON.
6. PLATE POWER SWITCH OFF.
7. SIDETONE SWITCH AT EITHER ON BC-342 OR ON BC-312.

NOTE: ⊣⊢ IS SYMBOL FOR FIXED CAPACITOR.

TL 19668

Figure 18. Speech Amplifier BC-614-F, fourth a-f amplifier stage.

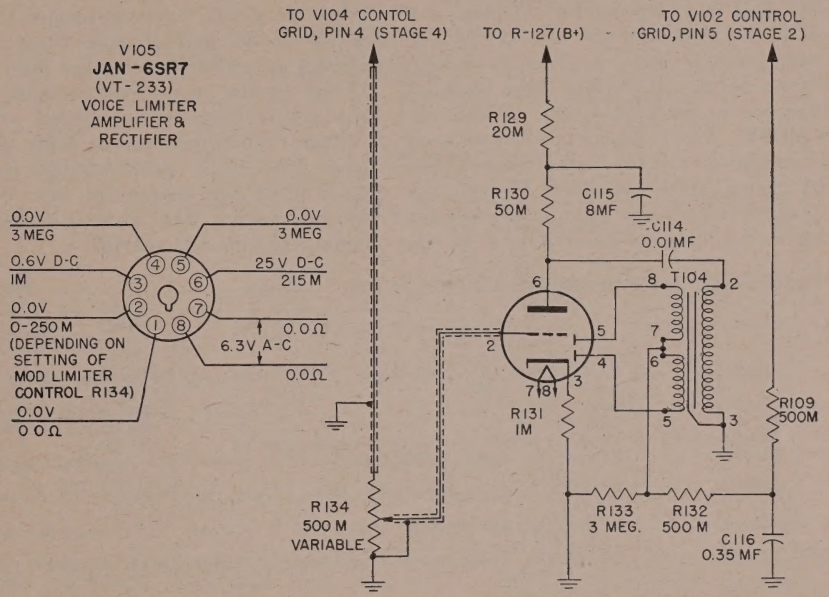
25. Voice Limiter, Amplifier, and Rectifier Stage

a. Special Circuit Features (fig. 19). A portion of the voltage on one of the grids of V104 is fed back to volume limiter control R134 which adjusts the voltage fed to the grid of tube V105 (a duo-diode triode). The plate voltage is supplied through the filter consisting of resistor R129 and capacitor C115. The voltage drop across resistor R131 provides grid bias to tube V105. The amplified voltage appears across plate resistor R130 and is fed through coupling capacitor C114 to the primary of transformer T104. The secondary applies the amplified voltages to the plate of the push-pull diodes inside tube V105. The resulting rectified voltage appears across resistor R133. The a-c components of the rectified voltage are removed by the filter network consisting of resistor R132 and capacitor C116. The output potential of this filter is applied as a variable bias voltage to the grid of tube V102 through resistor R109. Tube V102, as used in this circuit, has the property of varying its amplification constant with grid bias variations.

b. Parts Data for Voice Limiter, Amplifier, and Rectifier Stage.

Ref symbol	Signal Corps stock No.	Name of part and description	Function
C114	3DA10–128	CAPACITOR, fixed: 0.01 mf, ±20% mica; 600 vdcw; type MP–4134.	Plate coupling for tube V105.
C115	3DB8–35	CAPACITOR, fixed: 8 mf, −10+40%; electrolytic; 475 vdcw; special dual unit; see C11.	Audio decoupling for tube V105.
C116	3DA350–5	CAPACITOR, fixed: 0.35 mf, ±10%; paper; 400 vdcw; type 7476.	Mod limiter audio filter.
R129 E*	3Z6620–46	RESISTOR: 20,000 ohms, ±10%; ½ watt; carbon, type A–½.	Audio decoupling for tube V105.
R129	3Z6620–12	RESISTOR, fixed: 20,000 ohms, ±10%; 2 watts; type BT–2.	Audio decoupling for tube V105.
R130	3Z4531	RESISTOR, fixed: 50,000 ohms, ±10%; ½ watt; type BT–½.	Plate resistor for tube V105.
R131	3Z4525	RESISTOR, fixed: 1,000 ohms, ±10%; ½ watt; type BT–½.	Cathode bias for tube V105.
R131 E*	3Z4528	RESISTOR, fixed: 5,000 ohms, ±10%; ½-watt; type BT–½.	Cathode bias for tube V105.
R132	3Z4533	RESISTOR, fixed: 500,000 ohms, ±10%; ½-watt; type BT–½.	Mod limiter audio filter.
R133	3Z6803–3	RESISTOR, fixed: 3,000,000 ohms, ±20%; ½-watt; type BT–½.	Diode load of tube V105.
R134	2Z7298–4	RESISTOR, variable: 500,000 ohms, ±20%; special	Mod limiter control.
T104	2Z9634.2	TRANSFORMER: pri impedance 10,000 ohms, sec impedance 80,000 ohms; type 2A109.	Mod limiter transformer.
V105	2T233	TUBE: duo-diode triode; JAN–6SR7 (VT–233)	Mod limiter.

*Applies only to model indicated.



RESISTANCE MEASUREMENTS

1. ALL TUBES REMOVED.
2. TRANSMITTER CONTROL SWITCH AT TRANS OFF.
3. SIDETONE SWITCH AT ON BC-342.
4. NORMAL-REMOTE PHONE SWITCH AT NORMAL.
5. BOTH GAIN CONTROLS AT FULL GAIN
6. BOTH RECEIVER CONTROL SWITCHES AT AUTO.
7. ALL SOCKET MEASUREMENTS MADE TO CHASSIS GROUND
8. M = 1000 OHMS.

VOLTAGE MEASUREMENTS

1. MEASUREMENTS MADE WITH 1000 OHMS-PER-VOLT METER.
2. A-C LINE VOLTAGE APPROXIMATELY 117 VOLTS.
3. ALL MEASUREMENTS MADE TO CHASSIS GROUND.
4. TRANSMITTER CONTROL SWITCH AT TRANS OFF.
5. FILAMENT POWER SWITCH ON.
6. PLATE POWER SWITCH OFF.
7. SIDETONE SWITCH AT EITHER ON BC-342 OR ON BC-312.

NOTE: ⊣⊢ IS SYMBOL FOR FIXED CAPACITOR.

TL 19669

Figure 19. Speech Amplifier BC-614-A, -B, -C, -D, -E, and -F, voice limiter and rectifier stage.

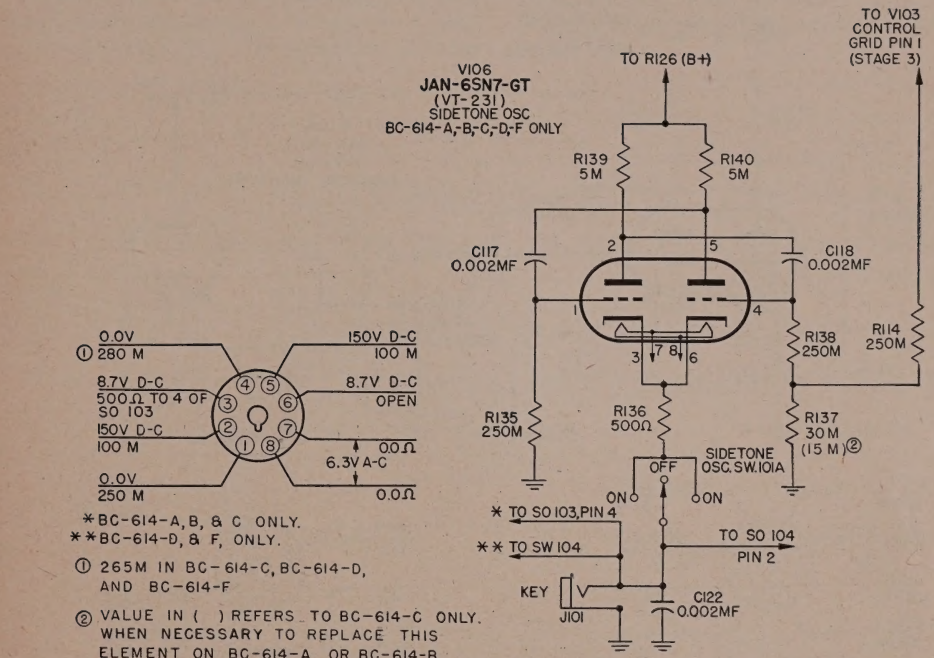
26. Sidetone Oscillator Stage

a. Special Circuit Features (figs. 20 and 21). Tube V106 is an audio oscillator of the multivibrator type. The tube is keyed by inserting a key in jack J101 or by operating key J–37. The cathode circuit of tube V106 is keyed in parallel with the cathode circuit of the oscillator tube in Radio Transmitter BC–610. Plate voltage is supplied to tube V106 through plate resistors R139 and R140. The grid leak resistors are R135 and series resistors R137 and R138. Capacitors C117 and C118 handle the coupling and feedback of the audio voltage and the voltage drop resistor across R136 provides grid bias. The sidetone switch SW101 has three positions (BC–614–E has no sidetone switch). The center position is OFF. The left-hand position turns on the audio oscillator (when the key is pressed) and feeds the output of the oscillator through the second section of switch SW101 to the headphones used with Radio Receiver BC–312–(*). In the right-hand position, the output is conducted to the headphones used with Radio Receiver BC–342–(*). To provide sufficient output a portion of the audio oscillator output is delivered through resistor R114 to the grid of tube V103 where it is amplified through this tube and through tube V104. The signal is then taken from the output circuit at the voltage-divider network R123 and R124, and conducted through switch SW101 and terminal No. 2 or No. 3 on socket SO102 to the appropriate receiver. In BC–614–E a portion of the audio signal voltage developed by tube V106 is fed to the grid of tube V108. Tube V108 isolates the multivibrator stage from the external keying circuits to prevent frequency changes in the multivibrator output signal voltage. The voltage drop across resistor R122 provides grid bias. The audio signal voltage for keying is taken from the cathode of tube V108, passes through resistor R141, and is impressed on terminal No. 5 of socket SO102.

b. Parts Data for Sidetone Oscillator Stage.

Ref symbol	Signal Corps stock No.	Name of part and description	Function
C117	3DA2–71	CAPACITOR, fixed: 0.002 mf, ±20%; mica; 500 vdcw; type 1467.	Plate coupling for tube V106.
C118	3DA2–71	Same as C117	Plate coupling for tube V106.
C122	3DA2–71	Same as C117	Key circuit r-f filter.
J101	2Z5524	JACK: 2-circuit; standard headphone type 2A	Key input.
R135	3Z4562	RESISTOR, fixed: 250,000 ohms, ±10%; ½ watt; type BT–½.	Grid resistor for tube V106.
R136	3Z4524	RESISTOR, fixed: 500 ohms, ±10%; ½ watt; type BT–½.	Cathode bias for tube V106.
R137 CD*	3Z4614	RESISTOR, fixed: 15,000 ohms, ±10%; ½ watt; type BT–½.	Grid resistor for tube V106.
R137 AB*	3Z4540	RESISTOR, fixed: 30,000 ohms, ±10%; ½ watt; type BT–½.	Grid resistor for tube V106.
R138	3Z4562	Same as R135	Grid resistor for tube V106.
R139	3Z4528	RESISTOR, fixed: 5,000 ohms ±10%; ½ watt; type BT–½.	Plate resistor for tube V106.
R140	3Z4528	RESISTOR, fixed: 5,000 ohms, ±10%; ½ watt; type BT–½.	Plate resistor for tube V106.
SW101A ABCDF*	3Z9825–34	SWITCH: 2-pole; 3-position; rotary; special (part of SW101, see 101B).	Receiver sidetone switching.
V106	2T231	TUBE: twin triode; JAN–6SN7GT (VT–231)	Sidetone oscillator.

*Applies only to model indicated.



*BC-614-A, B, & C ONLY.
**BC-614-D, & F, ONLY.

① 265M IN BC-614-C, BC-614-D, AND BC-614-F

② VALUE IN ( ) REFERS TO BC-614-C ONLY. WHEN NECESSARY TO REPLACE THIS ELEMENT ON BC-614-A OR BC-614-B, REPLACE WITH VALUE IN ( ).

RESISTANCE MEASUREMENTS

1. ALL TUBES REMOVED.
2. TRANSMITTER CONTROL SWITCH AT TRANS OFF.
3. SIDETONE SWITCH AT ON BC-342.
4. NORMAL-REMOTE PHONE SWITCH AT NORMAL.
5. BOTH GAIN CONTROLS AT FULL GAIN
6. BOTH RECEIVER CONTROL SWITCHES AT AUTO.
7. ALL SOCKET MEASUREMENTS MADE TO CHASSIS GROUND.
8. M = 1000 OHMS.

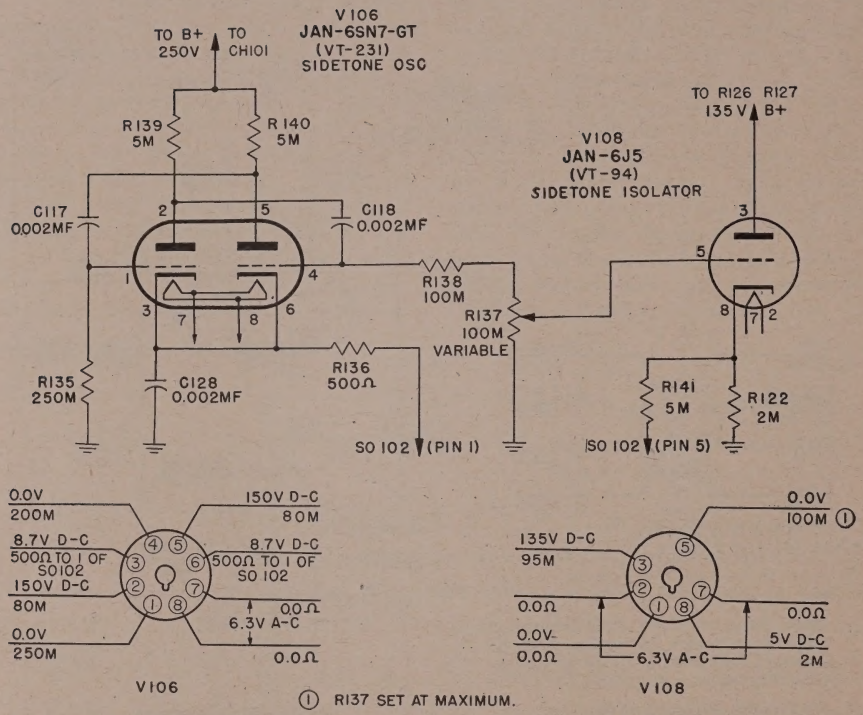
VOLTAGE MEASUREMENTS

1. MEASUREMENTS MADE WITH 1000 OHMS-PER-VOLT METER.
2. A-C LINE VOLTAGE APPROXIMATELY 117 VOLTS.
3. ALL MEASUREMENTS MADE TO CHASSIS GROUND.
4. TRANSMITTER CONTROL SWITCH AT TRANS OFF.
5. FILAMENT POWER SWITCH ON.
6. PLATE POWER SWITCH OFF
7. SIDETONE SWITCH AT EITHER ON BC-342 OR ON BC-312.

NOTE: ⊣⊢ IS SYMBOL FOR FIXED CAPACITOR.

TL 19670

Figure 20. Speech Amplifier BC-614-A, -B, -C, -D, and -F, sidetone oscillator stage.



① R137 SET AT MAXIMUM.

RESISTANCE MEASUREMENTS

1. ALL TUBES REMOVED.
2. TRANSMITTER CONTROL SWITCH AT TRANS OFF.
3. SIDETONE SWITCH AT ON BC-342.
4. NORMAL-REMOTE PHONE SWITCH AT NORMAL.
5. BOTH GAIN CONTROLS AT FULL GAIN.
6. BOTH RECEIVER CONTROL SWITCHES AT AUTO.
7. ALL SOCKET MEASUREMENTS MADE TO CHASSIS GROUND.
8. M = 1000 OHMS.

VOLTAGE MEASUREMENTS

1. MEASUREMENTS MADE WITH 1000 OHMS-PER-VOLT METER.
2. A-C LINE VOLTAGE APPROXIMATELY 117 VOLTS.
3. ALL MEASUREMENTS MADE TO CHASSIS GROUND.
4. TRANSMITTER CONTROL SWITCH AT TRANS OFF.
5. FILAMENT POWER SWITCH ON.
6. PLATE POWER SWITCH OFF.
7. SIDETONE SWITCH AT EITHER ON BC-342 OR ON BC-312.

NOTE: ⏚ IS SYMBOL FOR FIXED CAPACITOR.

TL 19671

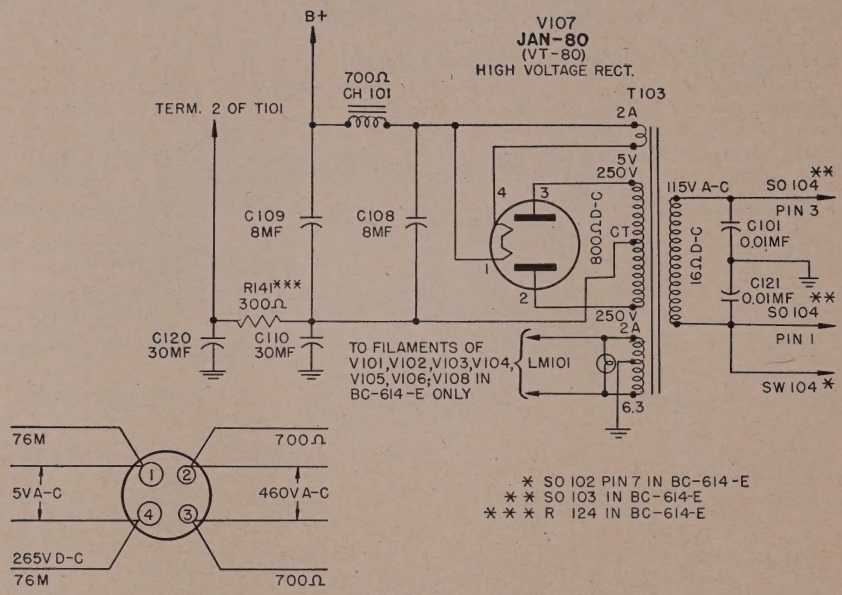
Figure 21. Speech Amplifier BC-614-E, sidetone oscillator stage.

27. High-Voltage Rectifier Stage

a. Special Circuit Features (fig. 22). A-c power is supplied to the speech amplifier through terminals No. 1 and No. 3 on receptacle SO104 (terminals No. 1 and No. 3 on receptacle SO103 in BC–614–E) from the transmitter when the transmitter FILAMENT POWER switch is closed. The a-c power is bypassed by capacitors C101 and C121 to eliminate radio-frequency feedback from the transmitter, then fed to the primary of transformer T103. One secondary of transformer T103 supplies 6.3 volts a-c to the filaments of all the tubes with the exception of the rectifier tube. Filament power for the rectifier is supplied by another secondary winding which furnishes 5 volts alternating current. Plate power to rectifier tube V107 is supplied by a secondary on transformer T103. The rectified output voltage is filtered by capacitors C108 and C109 and filter choke CH101. From the output of this filter the voltage is applied to bleeder resistor R125 and the B+ line.

b. Parts Data for High-Voltage Rectifier Stage.

Ref symbol	Signal Corps stock No.	Name of part and description	Function
C101	3DA10–128	CAPACITOR, fixed: 0.01 mf, ±20%; mica, 600 vdcw; type MP–4134 (model E moulded paper; type 342).	A-c power line filter.
C108	3DB8–35	CAPACITOR, fixed: 8 mf, −10, +40%; electrolytic, 475 vdcw; special; dual unit; see C109.	Power supply input filter.
C109	3DB8–35	Same as C108	Power supply output filter.
C121	3DA10–128	Same as C101	A-c line filter.
CH101	3C548	REACTOR: 29 henrys at 25 ma; dc; type 1C105	Filter.
LM101	2Z5927	LAMP: 6.3 volts; 250 ma; bayonet base; type 44	ON-OFF indicator.
R125	3Z6675–10	RESISTOR, fixed: 75,000 ohms, ±10%; 2-watt; type BT–2.	Power supply bleeder.
T103	2Z9615.2	TRANSFORMER, pri 117 volts ac sec (1) 500 volts CT at 25 ma; (2) 6.3 volts CT at 2 amps; (3) 5 volts at 2 amps; type 5C160.	Plate and fil power transf.
V107	2T80	TUBE: duo diode; JAN–80 (VT–80)	Power supply rectifier.



* SO 102 PIN 7 IN BC-614-E
** SO 103 IN BC-614-E
*** R 124 IN BC-614-E

RESISTANCE MEASUREMENTS

1. ALL TUBES REMOVED.
2. TRANSMITTER CONTROL SWITCH AT TRANS OFF.
3. SIDETONE SWITCH AT ON BC-342.
4. NORMAL-REMOTE PHONE SWITCH AT NORMAL.
5. BOTH GAIN CONTROLS AT FULL GAIN.
6. BOTH RECEIVER CONTROL SWITCHES AT AUTO.
7. ALL SOCKET MEASUREMENTS MADE TO CHASSIS GROUND.
8. M = 1000 OHMS.

VOLTAGE MEASUREMENTS

1. MEASUREMENTS MADE WITH 1000 OHMS-PER-VOLT METER
2. A-C LINE VOLTAGE APPROXIMATELY 117 VOLTS
3. ALL MEASUREMENTS MADE TO CHASSIS GROUND.
4. TRANSMITTER CONTROL SWITCH AT TRANS OFF.
5. FILAMENT POWER SWITCH ON.
6. PLATE POWER SWITCH OFF.
7. SIDETONE SWITCH AT EITHER ON BC-342 OR ON BC-312.

NOTE: ⫩ IS SYMBOL FOR FIXED CAPACITOR

TL 19672

Figure 22. Speech Amplifier BC-614-A, -B, -C, -D, -E, and -F, high-voltage rectifier.

SECTION IX

SUPPLEMENTARY DATA

28. Parts Identification

The following illustrations are provided to aid in identifying and servicing the various component parts of Speech Amplifier BC–614–(*).

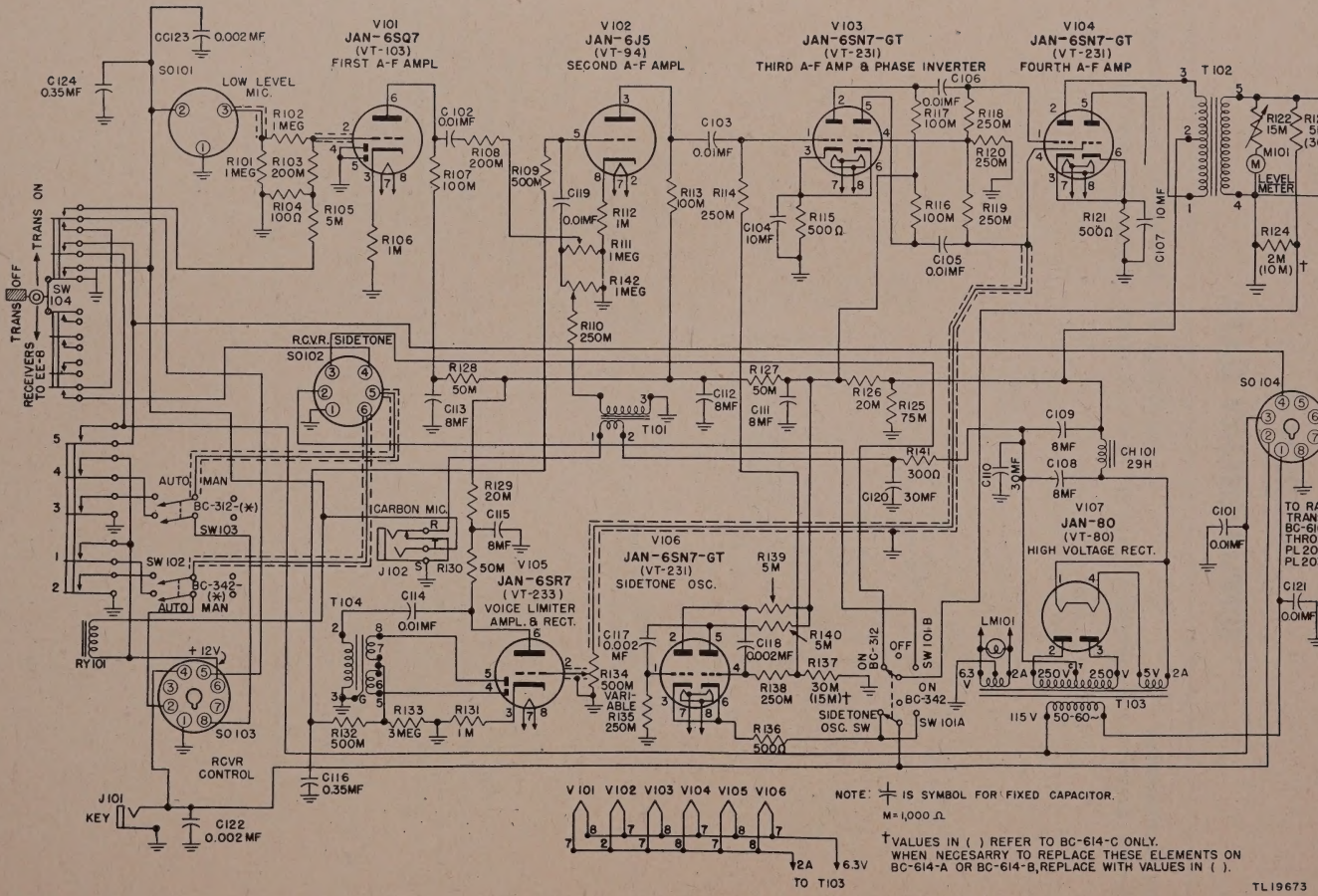


Figure 23. Speech Amplifier BC-614-A, -B, and -C, schematic wiring diagram.

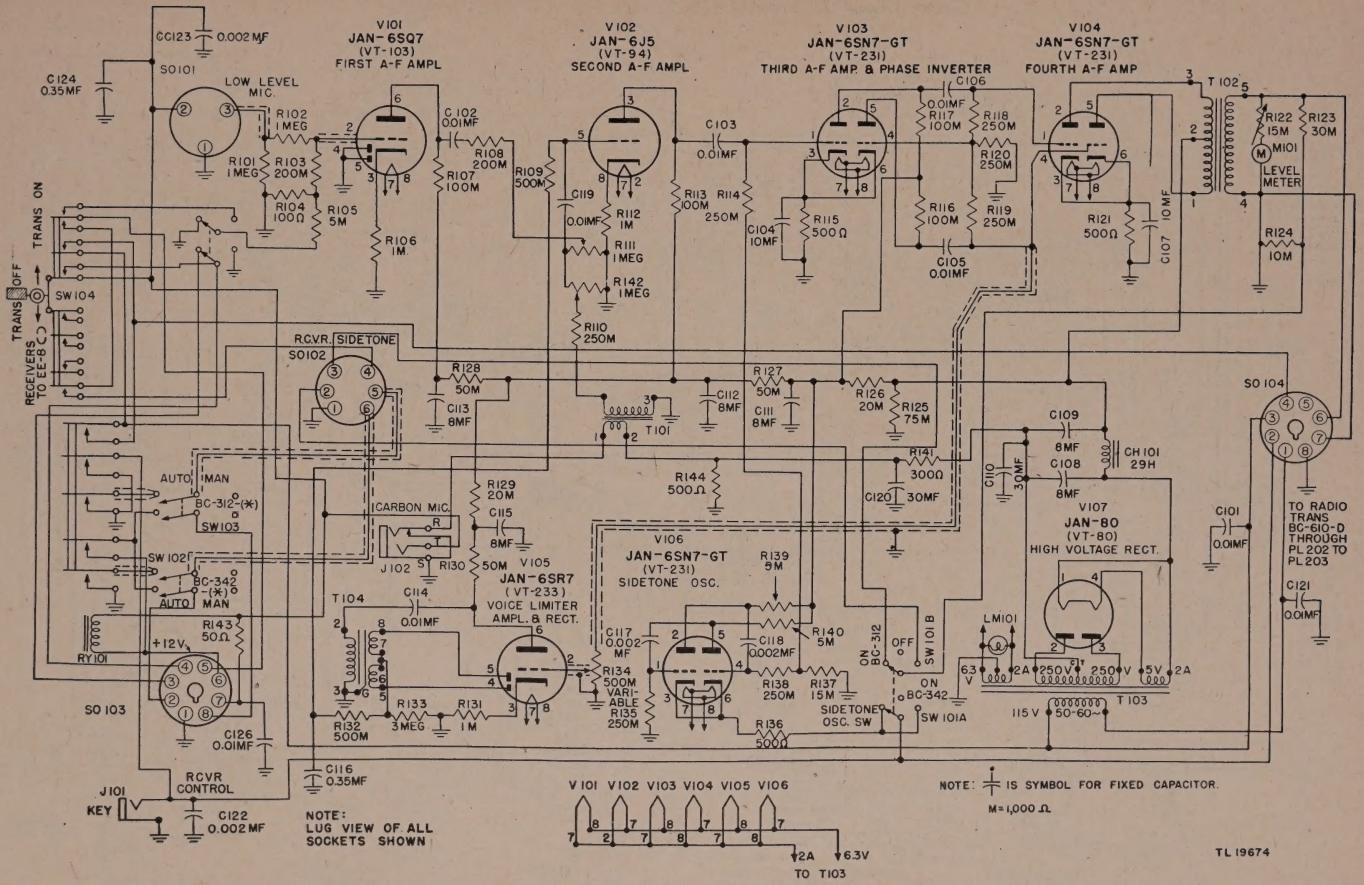


Figure 24. Speech Amplifier BC–614–D, schematic wiring diagram

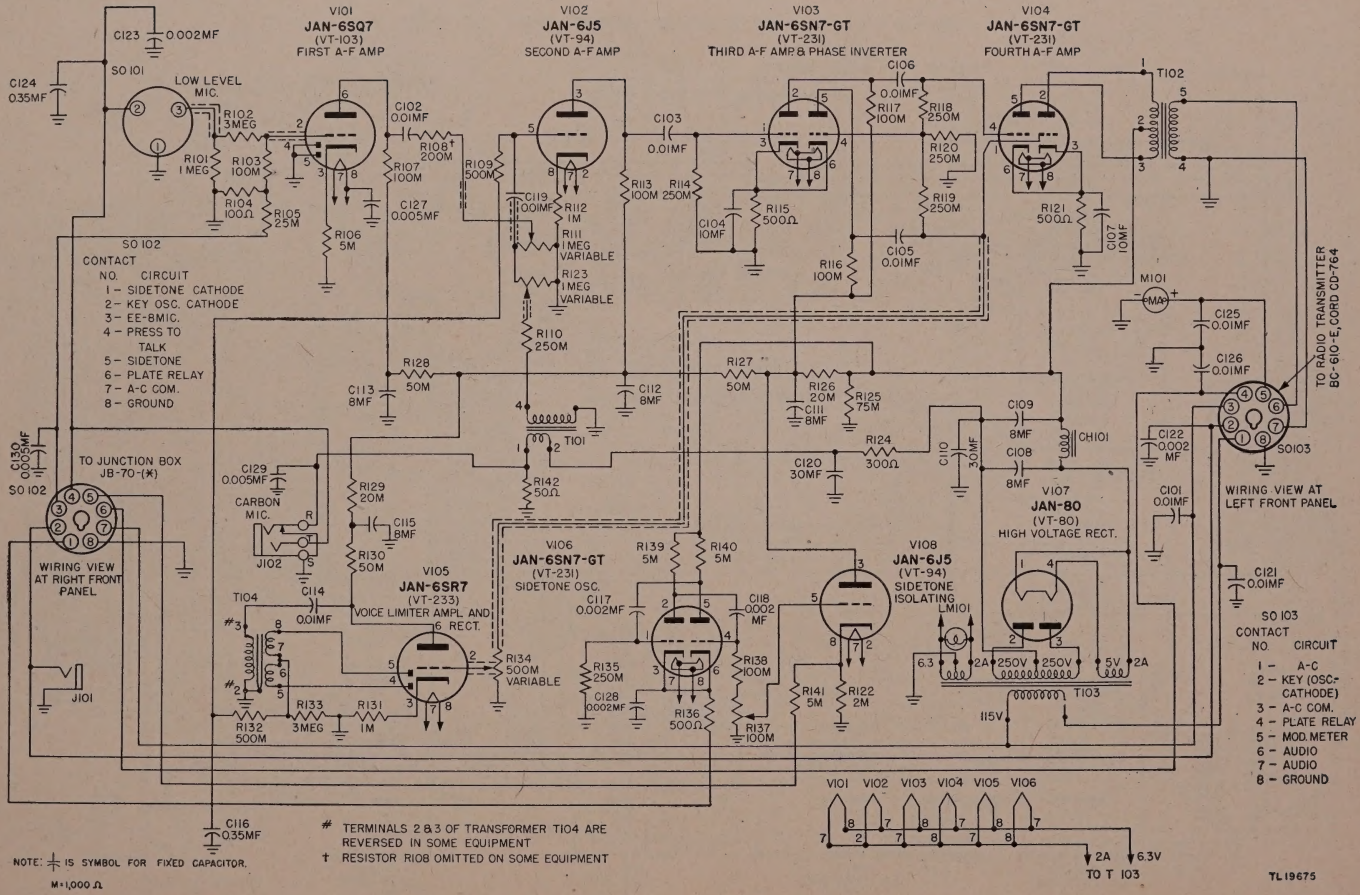


Figure 25. Speech Amplifier BC–614–E, schematic wiring diagram.

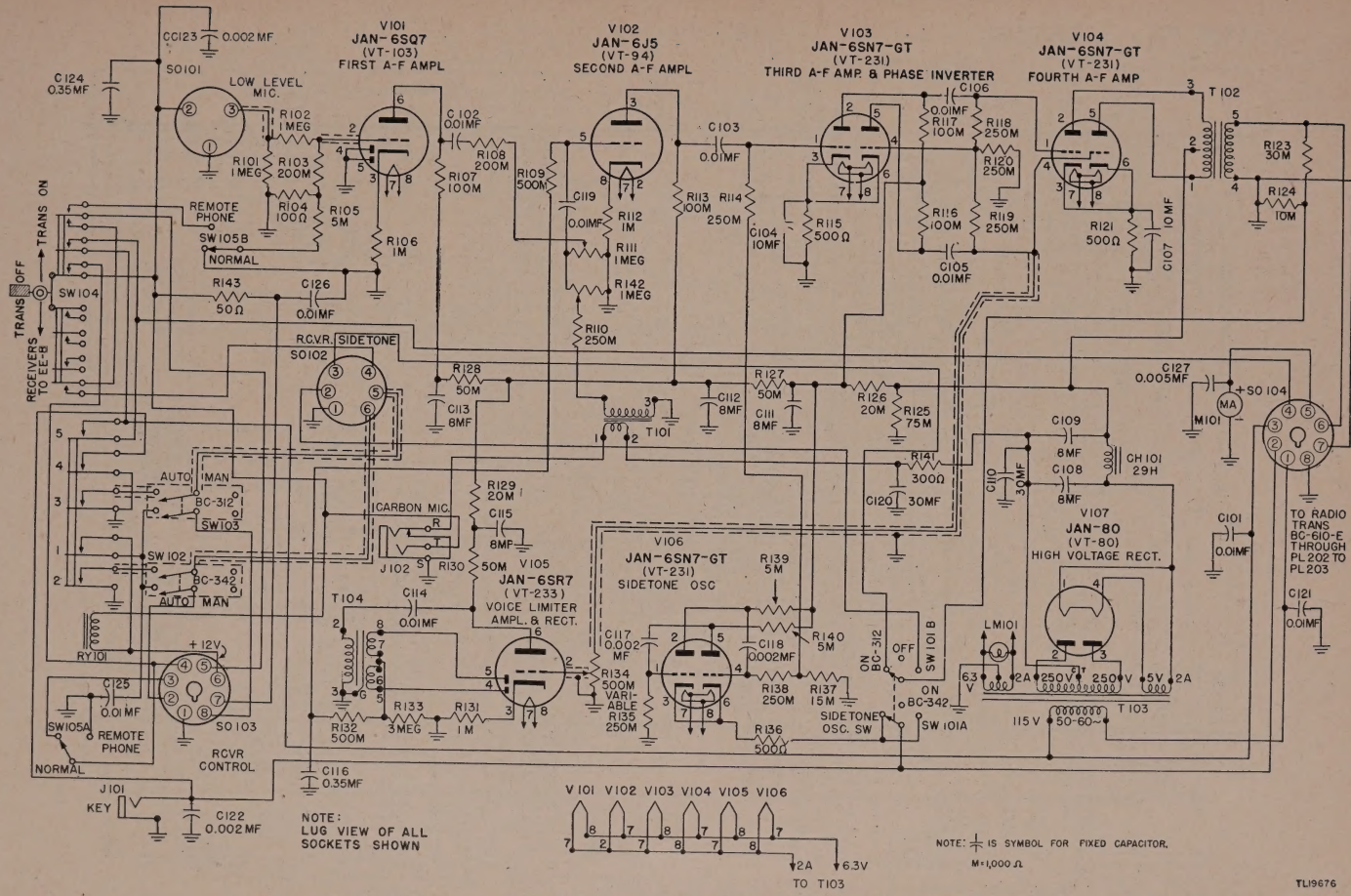


Figure 26. Speech Amplifier BC-614-F, schematic wiring diagram.

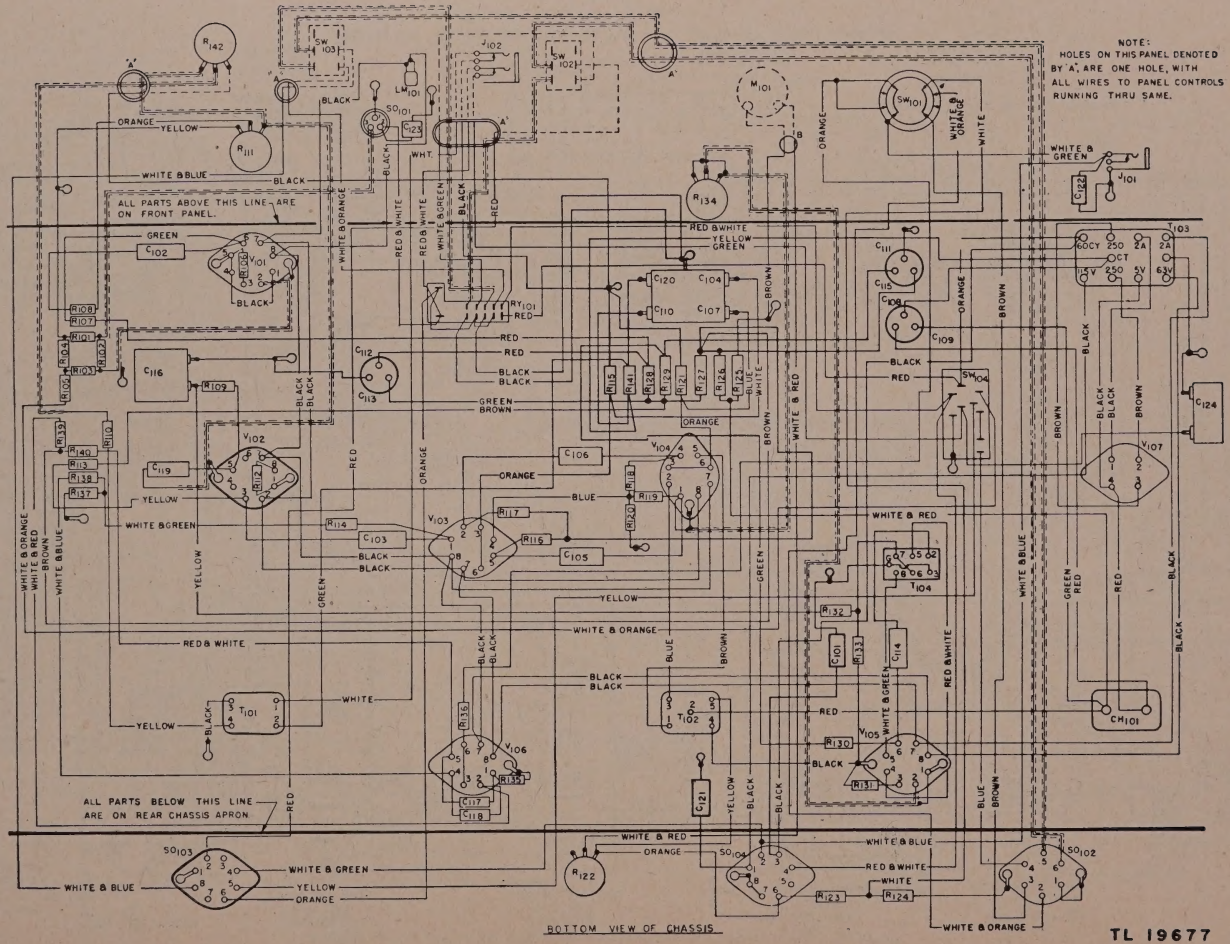

NOTE:
HOLES ON THIS PANEL DENOTED BY 'A' ARE ONE HOLE, WITH ALL WIRES TO PANEL CONTROLS RUNNING THRU SAME.
ALL PARTS ABOVE THIS LINE ARE ON FRONT PANEL.
ALL PARTS BELOW THIS LINE ARE ON REAR CHASSIS APRON
BOTTOM VIEW OF CHASSIS
TL 19677

Figure 27. Speech Amplifier BC-614-A, -B, and -C, practical wiring diagram.

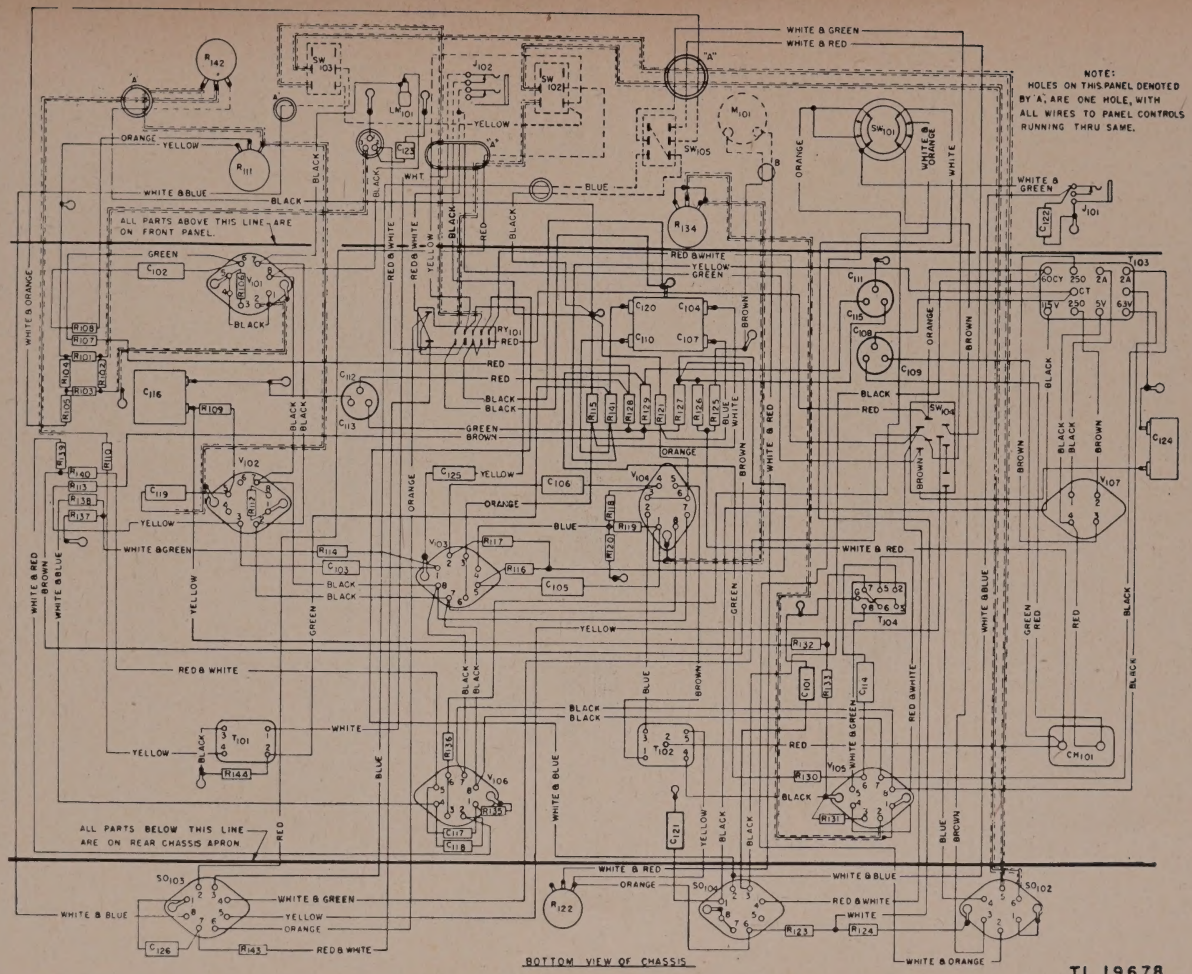
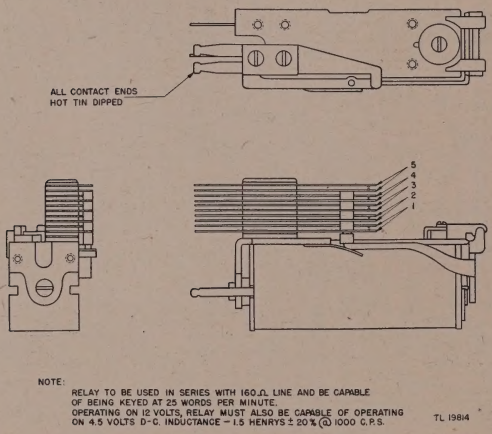

NOTE:
HOLES ON THIS PANEL DENOTED BY 'A' ARE ONE HOLE, WITH ALL WIRES TO PANEL CONTROLS RUNNING THRU SAME.
ALL PARTS ABOVE THIS LINE ARE ON FRONT PANEL.
ALL PARTS BELOW THIS LINE ARE ON REAR CHASSIS APRON
BOTTOM VIEW OF CHASSIS
TL 19678

Figure 28. Speech Amplifier BC–614–D, practical wiring diagram.

COIL SPECS.	BC-614-A,B,C	BC-614-D,E
RESISTANCE	200 Ω	100 Ω
TURNS	8400-#31-EC.	4700-#30-EC.
SIGNAL CORPS STOCK NO.	2Z7650	2Z76505



NOTE:
RELAY TO BE USED IN SERIES WITH 160 Ω LINE AND BE CAPABLE OF BEING KEYED AT 25 WORDS PER MINUTE.
OPERATING ON 12 VOLTS, RELAY MUST ALSO BE CAPABLE OF OPERATING ON 4.5 VOLTS D-C. INDUCTANCE – 1.5 HENRYS ± 20% @ 1000 C.P.S.

TL 19814

Figure 29. Speech Amplifier BC–614–A, –B, –C, –D, –E, and –F, relays.